VTAC 9 AC Drive
User Manual
Version 1.2

VT-1000

Instruction Manual

Saving Energy with Variable Speed.
VTAC DRIVES
by Rockwell Automation

The information in this manual is subject to change without notice.

Throughout this manual, the following notes are used to alert you to safety considerations:

ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss.

Important: Identifies information that is critical for successful application and understanding of the product.

ATTENTION: Only qualified personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate, or service this equipment. Read and understand this document in its entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.

ATTENTION:DC bus capacitors retain hazardous voltages after input power has been removed. After disconnecting input power, wait five minutes for the DC bus capacitors to discharge and then check the voltage with a voltmeter to ensure the DC bus capacitors are discharged before touching any internal components. Failure to observe this precaution could result in severe bodily injury or loss of life.

ATTENTION: The drive can operate at and maintain zero speed. The user is responsible for assuring safe conditions for operating personnel by providing suitable guards, audible or visual alarms, or other devices to indicate that the drive is operating, or may operate, at or near zero speed. Failure to observe this precaution could result in severe bodily injury or loss or life.

ATTENTION: The drive contains ESD- (Electrostatic Discharge) sensitive parts and assemblies. Static control precautions are required when installing, testing, servicing, or repairing the drive. Erratic machine operation and damage to, or destruction of, equipment can result if this procedure is not followed. Failure to observe this precaution can result in bodily injury.

ATTENTION: The user must provide an external, hardwired emergency stop circuit outside of the drive circuitry. This circuitry must disable the system in case of improper operation. Uncontrolled machine operation may result if this procedure is not followed. Failure to observe this precaution could result in bodily injury.

ATTENTION: The user is responsible for conforming with all applicable local and national codes. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

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Introduction

This manual is intended for qualified electrical personnel familiar with installing, programming, and maintaining AC drives.

This manual contains information on:

- Installing and wiring the VTAC 9 drive and options cabinet
- Programming the drive
- Troubleshooting the drive

The latest version of this manual is available from http://www.theautomationbookstore.com or http://www.vtacdrives.com.

Conventions

Parameter names: In most instances, parameter names are shown as the parameter name followed by the parameter number. For example: PI Control (125).

Getting Assistance from Rockwell Automation

If you have any questions or problems with the products described in this instruction manual, contact your authorized Rockwell Automation VTAC drive representative.

For technical assistance, call 1-440-646-7271. Before calling, please review the troubleshooting section of this manual and check the VTAC drives website for additional information. When you call this number, you will be asked for the drive model number and this instruction manual number. Also, please have your product version number ready (refer to Chapter 12).

About the Drive

The VTAC 9 drive is a pulse-width-modulated (PWM) drive that provides general purpose (volts/hertz) regulation for a broad range of applications requiring adjustable speed control of motors.

This chapter provides information about the VTAC 9 drive, including:

- Information on identifying the drive
- Descriptions of NEMA ratings
- A description of the drive connections and communication options
- An overview of the bypass option

Identifying the Drive by Model or System Number

Each VTAC 9 drive can be identified by its model number, as shown in Figure 2.1 and Figure 2.2. There are two distinct model number strings; one for drive-only model numbers, the other for drives with an options cabinet. The model number is on the drive nameplate. The model number includes the drive and any options. Drive power ratings are provided in Table 2.A.

Figure 2.1 Drive by Model Number - Drive Only

Position

1-3	4	5-7	8	9	10	11	12	13
9VT	**2**	**01**	**017**	**H**	**T**	**A**	**N**	**A**
Drive	Voltage Rating	Enclosure	Rating	OIM	Braking Transistor	Filter	DC Bus	Emission

Code	Type
9VT	VTAC 9

Code	Voltage	Ph.
2	208V AC	3
4	408V AC	3
5	575V AC	3

Code	Enclosure
01	NEMA Type 1

Output Current @ 208V 60Hz Input

Code	Amps	HP	kW
011	11	3	2.2
017	17	5	4
025	25	7.5	5.5
32	32	10	7.5

Output Current @ 480V 60Hz Input

Code	Amps	HP	kW
008	8	5	4
011	11	7.5	5.5
014	14	10	7.5
022	22	15	11
027	27	20	15
034	34	25	20
040	40	30	22
052	52	40	30
065	65	50	37
077	77	60	45
096	96	75	67
125	125	100	87
156	156	125	93
180	180	150	112

Code	OIM
B	Blank OIM
F	125-150 w/LCD OIM
H	LCD OIM

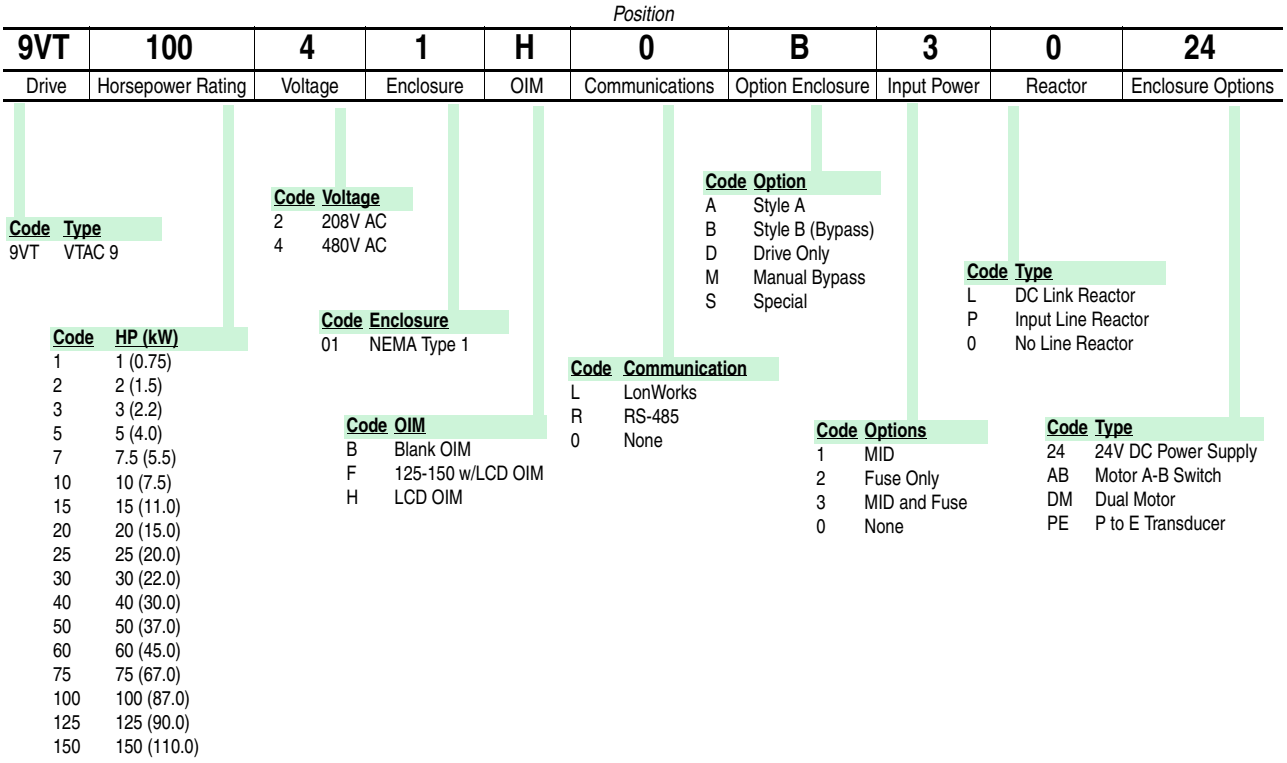
Code	Brake
T	Braking Transistor
N	None

Code	Filter
A	Filter
N	None

Code	DC Bus
A	DC Bus Inductor
N	None

Code	Type
A	24V I/O (25 HP and larger)

Figure 2.2 Drive by Model Number - Drive Only System Number and Drive with Options Cabinet



Power and NEMA Enclosure Ratings

Each of the VTAC 9 drives has one of these NEMA ratings:

- Open: Unprotected drive for use in another enclosure.
- NEMA 1: Vented. Intended for general-purpose indoor applications.

Table 2.A is a listing of the drives and their NEMA ratings.

Table 2.A Power and NEMA Enclosure Ratings

Model Number	HP	Input Voltage (VAC) ±10%	Input KVA	Input Amps	Output Amps @ 4 kHz(1)	Watts Loss @ 4 kHz
9VT-121xx-xxx-xx	1	208	1.4	3.7	4.2	68
9VT-141xx-xxx-xx	1	480	1.4	1.6	2.1	52
9VT-221xx-xxx-xx	2	208	2.4	6.8	7.8	88
9VT-241xx-xxx-xx	2	480	2.2	2.6	3.4	75
9VT-321xx-xxx-xx	3	208	3.4	9.5	11.0	130
9VT-341xx-xxx-xx	3	480	3.2	3.9	5.0	98
9VT-521xx-xxx-xx	5	208	5.7	15.7	17.5	240
9VT-541xx-xxx-xx	5	480	5.7	6.9	8.0	136
9VT-721xx-xxx-xx	7.5	208	8.3	23.0	25.3	307
9VT-741xx-xxx-xx	7.5	480	7.9	9.5	11	174
9VT-1021xx-xxx-xx	10	208	10.7	29.6	32.2	420
9VT-1041xx-xxx-xx	10	480	10.4	12.5	14	229
9VT-1541xx-xxx-xx	15	480	16.6	19.9	22	344
9VT-2041xx-xxx-xx	20	480	20.6	24.8	27	480
9VT-2541xx-xxx-xx	25	480	25.9	31.2	34	445.8
9VT-3041xx-xxx-xx	30	480	30.5	36.7	40	458
9VT-4041xx-xxx-xx	40	480	39.7	47.7	52	609
9VT-5041xx-xxx-xx	50	480	49.6	59.6	65	716
9VT-6041xx-xxx-xx	60	480	60.1	72.3	77	1075
9VT-7541xx-xxx-xx	75	480	74.9	90.1	96	1142
9VT-10041xx-xxx-xx	100	480	97.6	117	125	1470
9VT-12541xx-xxx-xx	125	480	122	147	156	1891.72
9VT-15041-xx-xxx-xx	150	480	141	169	180	2396.10

(1) For Higher carrier frequencies, refer to Chapter 11, parameter 151.

Overview of VTAC 9 Features

This section provides an overview of the features in the VTAC 9 AC drive.

Analog Inputs

There are two general-purpose analog inputs that can be configured either as voltage (±10V DC) or current (4-20 mA) inputs. These inputs are configured via parameters to provide some flexibility.

The analog inputs provide input signals that can be used for the following purposes:

- Provide a value to [Speed Ref A] (90)
- Provide a trim signal to Speed Ref A (117, 118)
- Provide the reference and feedback for the process PI loop [PI Reference Sel] (126) and [PI Feedback Sel] (128)
- Provide an external value for the current limit and DC braking level [Current Lmt Sel] (147) and [DC Brake Lvl Sel] (157)
- Enter and exit sleep mode (178 to 183)

Analog Outputs

The drive has one analog output that can be used as a voltage or current(1) (4-20 mA) signal to annunciate a wide variety of drive operating conditions and values. Select the source for the analog output by setting [Analog Out1 Sel] (342).

(1) Current (4-20 mA) signal is available on drives 25 HP and larger

Auto Restart (Reset/Run)

The Auto Restart feature (see parameters 174 and 175) enables the drive to automatically perform a fault reset followed by a start attempt without user or application intervention. This allows for automatic restart in applications where the drive is used in remote or "unattended" operation.

Only certain faults are allowed to be auto reset. Faults that indicate possible drive malfunction are not resettable. Caution should be used when enabling this feature, since the drive will attempt to issue its own start command based on user-selected programming.

Reflected Wave Reduction (Motor Cable Lengths)

The length of cable between the drive and motor may be limited for various application reasons. The primary areas of concern are :

- Reflected wave
- Cable charging

The reflected wave phenomenon, also known as transmission line effect, produces very high peak voltages on the motor due to voltage reflection. While VTAC drives have patented software that limits the voltage peak to 2 times the DC bus voltage and reduce the number of occurrences, many motors have inadequate insulation systems to tolerate these peaks.

Caution should be taken to understand the effects and restrictions when applying the drive to extended motor lead length applications. Proper cable type, motor and drive selection is required to minimize the potential risks.

Drive Protection Current Limit

There are six ways that the drive automatically protects itself from overcurrent or overload situations:

- Instantaneous overcurrent trip
- Software Instantaneous trip
- Software current limit
- Heatsink temperature protection
- Overload protection IT
- Thermal management

Drive Overload Protection

The drive thermal overload will protect the drive power stage while maintaining performance as long the drive temperature and current ratings are not exceeded.

The drive will monitor the temperature of the power module based on a measured temperature and a thermal model of the IGBT. As the temperature rises, the drive may lower the PWM frequency to decrease the switching losses in the IGBT. If the temperature continues to rise, the drive may reduce current limit to try to decrease the load on the drive. If the drive temperature becomes critical, the drive will generate a fault.

If the drive is operated in a low ambient condition, the drive may exceed rated levels of current before the monitored temperature becomes critical. To guard against this situation, the drive thermal overload also includes an inverse time algorithm. When this scheme detects operation beyond rated levels, current limit may be reduced or a fault may be generated.

Digital Outputs

The VTAC 9 drive provides two relay outputs for external annunciation of a variety of drive conditions (see parameters 380 and 387). Each relay is a Form C (1 N.O. - 1 N.C. with shared common) device whose contacts and associated terminals are rated for a maximum of 250V AC or 220V DC.

Economizer Mode

Economizer mode consists of operating the drive in sensorless vector control mode with an energy saving function (E-SVC). When the drive is in this mode and operating at steady state output frequency, the output voltage is automatically adjusted as the load is increased or decreased. This is done so that minimum current is supplied to the motor thereby optimizing its efficiency. By adjusting the output voltage, the flux-producing current is reduced, but only if the total drive output current does not exceed 75% of motor rated current. In this mode, the flux current is not allowed to be less than 50% of the selected flux current parameter value.

Fan Curve (Factory Default)

When [Torque Perf Mode] (53) is set to Fan/Pump V/Hz the relationship between frequency and voltage is a square function where the voltage is proportional to frequency. The fan curve provides the option to generate voltage that is a function of the stator frequency squared up to the motor nameplate frequency. Above base frequency, the voltage is a linear function of frequency. At low speed, the fan curve can be offset by the [Run Boost] (70) parameter to provide necessary starting torque.

Flying Start

The flying start feature (see parameter 169) is used to start into a rotating motor as rapidly as possible and resume normal operation with a minimal impact on load or speed. This action will prevent an overcurrent trip and significantly reduce the time for the motor to reach its desired frequency. Since the motor is "picked up" smoothly at its rotating speed and ramped to the proper speed, little or no mechanical stress is present.

Motor Overload

The motor thermal overload function uses an I^2T algorithm to model the temperature of the motor. This curve is modeled after a Class 10 protection thermal overload relay that produces a theoretical trip at 600% motor current in ten (10) seconds and continuously operates at full motor current.

Parameter Access Level

The VTAC 9 drive allows the user to limit the number of parameters that are viewable on the LCD OIM. By limiting the parameter view to the most commonly adjusted set, additional features that may make the drive seem more complicated are hidden.

If you are trying to gain access to a particular parameter and the OIM skips over it, you must change the parameter view from "Basic" to "Advanced." See Chapter 10 for instructions.

Preset Frequency

There are seven preset frequency parameters (101 to 107) that are used to store a discrete frequency value. This value can be used for a speed reference or process PI Reference. When used as a speed reference, they are selected via the digital inputs or the DPI reference command.

Process PI Loop

The internal process PI function (see parameters 124 to 138) provides closed-loop process control with proportional and integral control action. The PI function reads a process variable input to the drive and compares it to a desired setpoint stored in the drive. The algorithm will then adjust the output of the process PI regulator thereby changing drive output frequency to try to make the process variable equal the setpoint.

S Curve

The S Curve function (parameter 146) of VTAC 9 drives allows control of the "jerk" component of acceleration and deceleration through user adjustment of the S Curve parameter (146). Jerk is defined as the rate of change of acceleration and or deceleration. By adjusting the percentage of S Curve applied to the normal accel/ decel ramps, the ramp takes the shape of an "S" allowing a smoother transition that produces less mechanical stress and smoother control for light loads.

Skip Bands

The skip band function (see parameters 84 to 87) provides three skip bands that the drive will ramp through but will not continuously run within. You can set the skip frequency (center frequency) for each band and the skip band centered on the skip frequency. The skip band applies to all three skip frequencies.This is used to avoid resonance operating frequency setpoints.

Speed Control

The purpose of speed regulation is to allow the drive to adjust to certain operating conditions, such as load change, and compensate for these changes in an attempt to maintain motor shaft speed within the specified regulation percentage.

The Speed Mode parameter (80) selects the speed regulation method for the drive, and can be set to one of 3 choices

- Open Loop - No speed control is offered
- Slip Comp - Slip Compensation is active
- Process PI - The PI Loop sets the actual speed based on process variables

Configured Cabinet Options

The VTAC 9 drive may be ordered as a stand-alone unit, or may be factory configured with any one of the following option styles:

- Style A: This option includes the padlockable door-interlocked main input disconnect. Input line fuses may be added to this configuration as an option.
- Style B: This option includes a 3-contactor bypass circuit with the bypass interface control board. A padlockable door-interlocked main input disconnect and input line fuses may be added to this configuration as an option.
- Style M: This option includes a 3-contactor bypass circuit and input line fuses. This bypass option is a simplified version of style B. Fuses are standard; however, no bypass interface control board or auto/manual switch is included. The only option for style M is a network communication interface module.
- Style S: This option is for special configurations. The size of the option cabinet is larger than that of a Style B option cabinet to accomodate special devices.

The following are some special options that can be ordered in a Style S option cabinet:

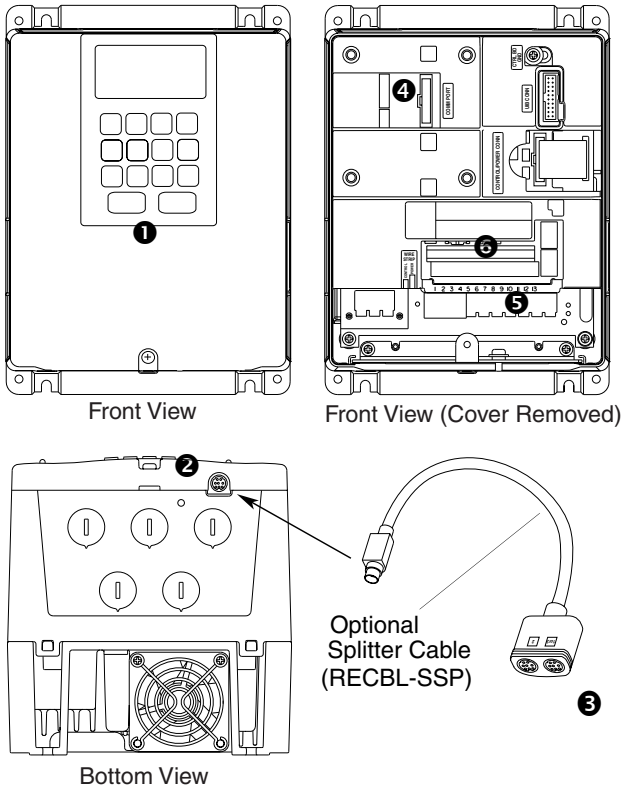
- Dual motor operation: Two motors connected to the same drive and running simultaneously.
- A or B Motor Selector Switch: Two same-sized motors connected to the same drive, only one motor running at a time.
- Pressure-to-Electrical transducer: For controlling motor speed with input from an external pressure sensor.
- Isolated 24V DC (500 mA) Power Supply: Additional power supply option for user's external 24V DC devices such as sensors, etc.
- Three-phase input line reactor

For other special option configurations, please contact your VTAC AC drive representative.

Drive Connections

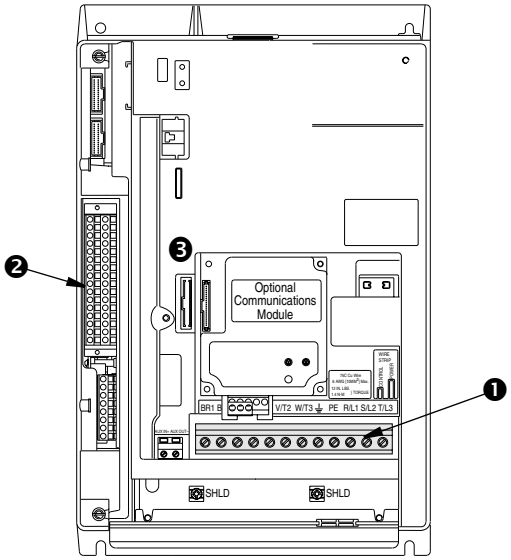
Figure 2.3 and Figure 2.41 show the locations of the drive terminal blocks and connectors used to set up and operate the drive.

Figure 2.3 Drive Only Connections - 1 to 20 HP



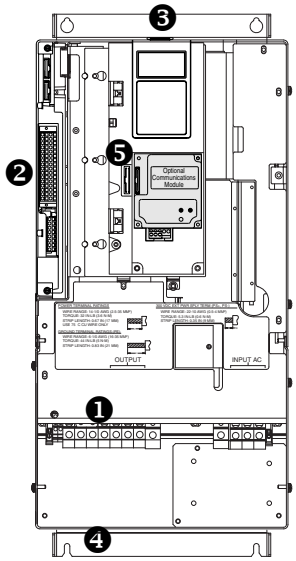
No.	Connector	Description
❶	DPI Port 1	OIM connection when installed in cover.
❷	DPI Port 2	Cable connection for remote OIM or PC Software.
❸	DPI Port 3	Cable connection for remote OIM or PC Software.
❹	DPI Port 5	Connection for optional communications module.
❺	Power Terminal Block	Connections for input and output power wiring.
❻	Signal and I/O Terminal Block	Connections for signal and I/O wiring.

Figure 2.4 Drive Only Connections - 25 to 50 HP



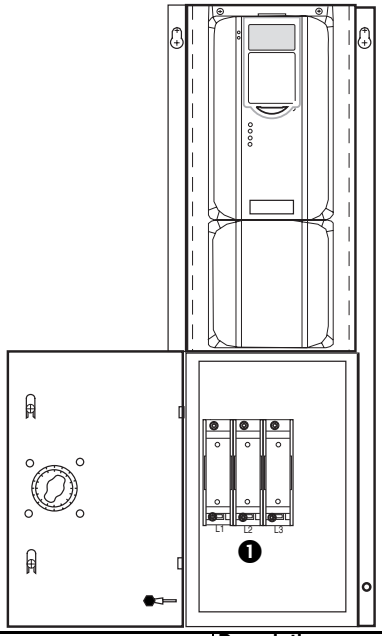
No.	Connector	Description
❶	Power Terminal Block	Connections for input and output power wiring.
❷	Signal and I/O Terminal Block	Connections for signal and I/O wiring.
❸	DPI Port 5	Connection for optional communications module.

Figure 2.5 Drive Only Connections - 60 to 150 HP



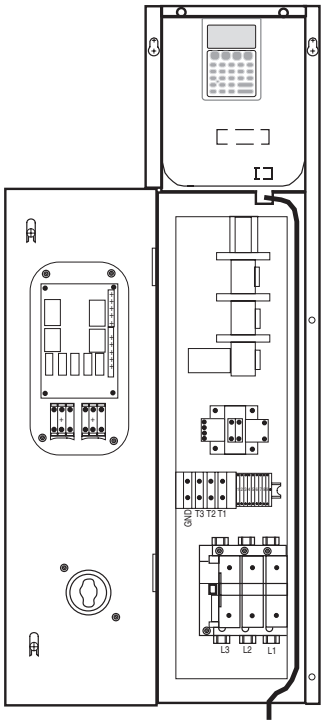
No.	Connector	Description
❶	Power Terminal Block	Connections for input and output power wiring.
❷	Signal and I/O Terminal Block	Connections for signal and I/O wiring.
❸	DPI Port 1	OIM connection.
❹	DPI Port 2	Connection for remote OIM or RECOMM-232 serial interface.
❺	DPI Port 5	Connection for optional communications module.

Figure 2.6 Style A Options Cabinet Connections - 1 to 150 HP



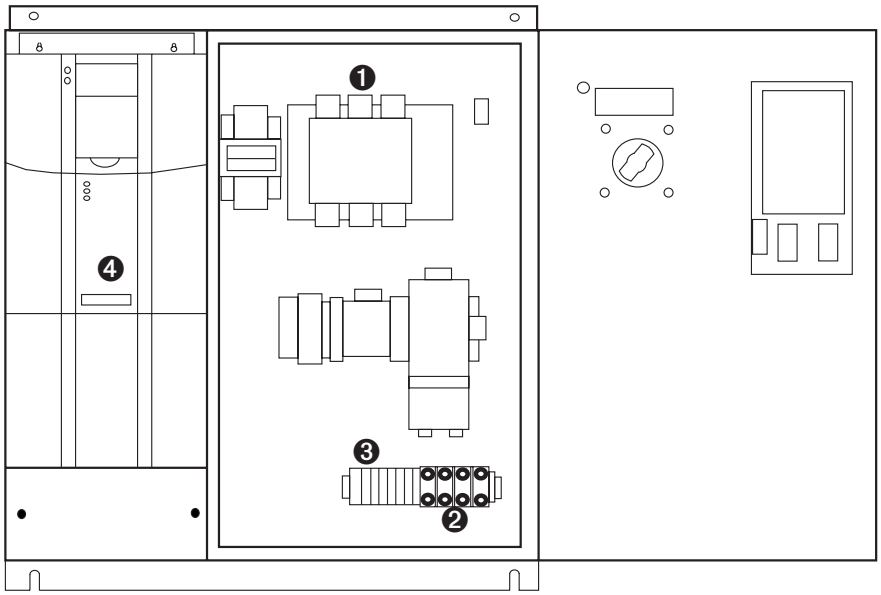
No.	Connector	Description
❶	Input Power Terminal Block	Customer connections for input power wiring.
All other customer connections are made at the drive unit terminal blocks (see figure 2.3)		

Figure 2.7 Style B Options Cabinet Connections - 1 to 25 HP



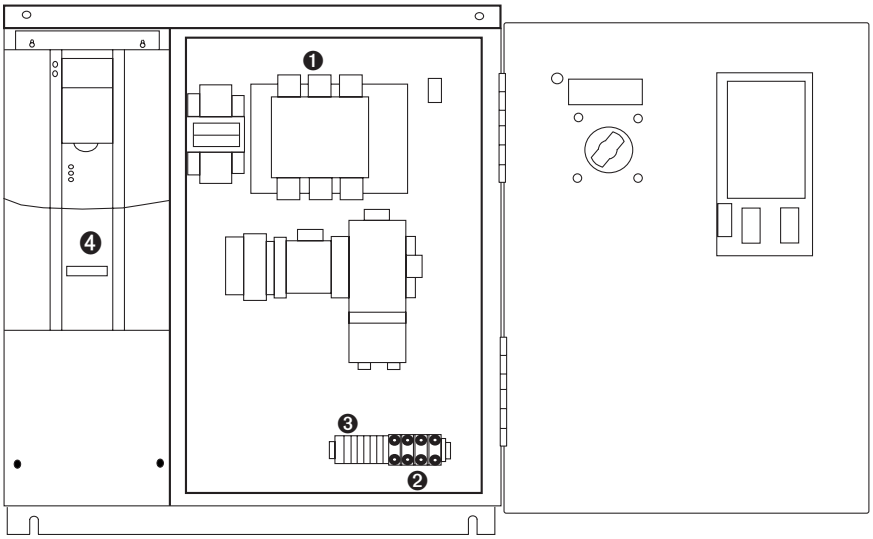
No.	Connector	Description
❶	Input Power Terminal Block	Customer connections for input power wiring.
❷	Output Power Terminal Block	Customer connections for output power (motor) wiring.
❸	Control Terminal Block	Customer connections for I/O wiring.
❹	Signal Terminal Block	Customer connections for signal wiring.

Figure 2.8 Style B Options Cabinet Connections - 30 to 50 HP



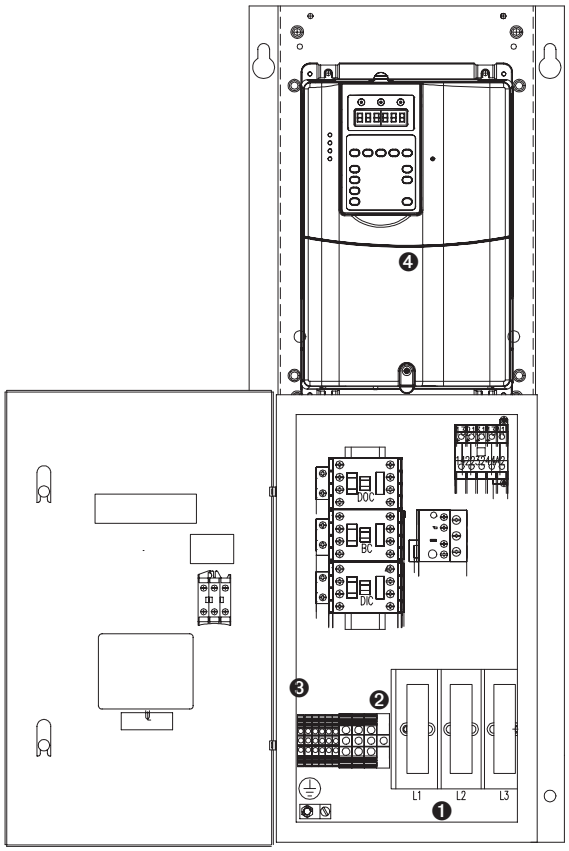
No.	Connector	Description
1	Input Power Terminal Block	Customer connections for input power wiring.
2	Output Power Terminal Block	Customer connections for output power (motor) wiring.
3	Control Terminal Block	Customer connections for I/O wiring.
4	Signal Terminal Block	Customer connections for signal wiring.

Figure 2.9 Style B Options Cabinet Connections - 60 to 150 HP



No.	Connector	Description
1	Input Power Terminal Block	Customer connections for input power wiring.
2	Output Power Terminal Block	Customer connections for output power (motor) wiring.
3	Control Terminal Block	Customer connections for I/O wiring.
4	Signal Terminal Block	Customer connections for signal wiring.

Figure 2.10 Style M Options Cabinet Connections - 1 to 20 HP



20 HP shown

No.	Connector	Description
❶	Input Power Terminal Block	Customer connections for input power wiring.
❷	Output Power Terminal Block	Customer connections for output power (motor) wiring.
❸	Control Terminal Block	Customer connections for I/O wiring.
❹	Signal Terminal Block	Customer connections for signal wiring.

Drive Communication Options

The flat-ribbon cable connector (labeled ❹ in Figure 2.3 and ❸ in Figure 2.4) is a parallel bus connection port that provides a means of attaching optional communication modules such as the RS485 Network Communication kit to the VTAC 9 drive.

Refer to the appropriate instruction manual for more information. See Table 2.B for a list of available kits and options. Note that these may be factory-installed with the base drive.

Table 2.B Standard Kits and Options

Kit Description	Option Kit Model Number	Instruction Manual
Serial Converter	RECOMM-232 (includes VS Utilities Software)	D2-3477 D2-3488
LONWorks Network Communication	RECOMM-LON	VT-1002
RS485 Network Communication	RECOMM-H485	VT-1001

Mounting the Drive

This chapter provides information that must be considered when planning a VTAC 9 drive installation and provides drive mounting information. Installation site requirements, drive requirements, and wiring requirements are presented.

ATTENTION: Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate, or service this equipment. Read and understand this manual and other applicable manuals in their entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.

ATTENTION: Use of power correction capacitors on the output of the drive can result in erratic operation of the motor, nuisance tripping, and/or permanent damage to the drive. Remove power correction capacitors before proceeding. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

ATTENTION: The user is responsible for conforming with all applicable local, national, and international codes. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

General Requirements for the Installation Site

It is important to properly plan before installing a VTAC 9 drive to ensure that the drive's environment and operating conditions are satisfactory.

Note that no devices are to be mounted behind the drive. If air-cooled devices are mounted near the drive, the hot air exhaust may raise the ambient temperature level above what is allowed for safe operation of the drive.

The area behind the drive must be kept clear of all control and power wiring. Power connections may create electromagnetic fields which may interfere with control wiring or components when run in close proximity to the drive.

Read the recommendations in the following sections before continuing with drive installation.

Verifying Power Module AC Input Ratings Match Available Power

VTAC 9 drives are suitable for use on a circuit capable of delivering up to a maximum of 100,000 rms symmetrical amperes, and a maximum of 480 volts (nominal).

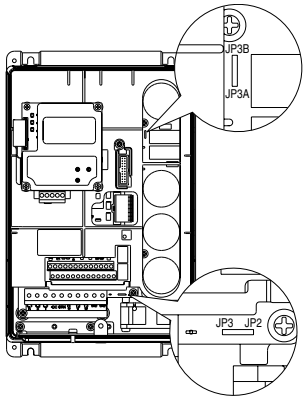
ATTENTION: To guard against personal injury and/or equipment damage caused by improper fusing selection, use only the recommended line fuses specified in Chapter 4.

Unbalanced or Ungrounded Distribution Systems

ATTENTION: VTAC 9 drives contain protective MOVs and common mode capacitors that are referenced to ground. These devices should be disconnected if the drive is installed on an ungrounded distribution system. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

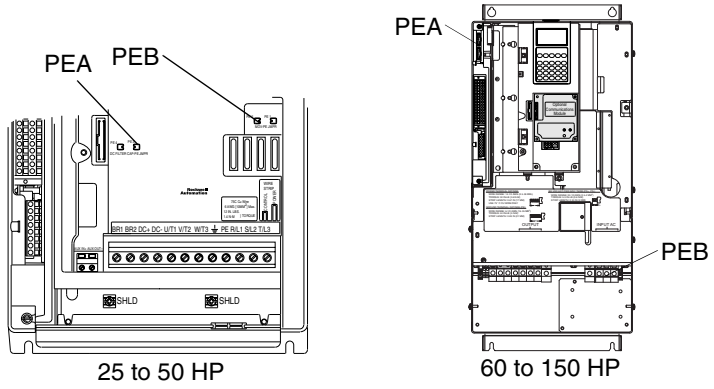
To disconnect the MOVs and common mode capacitors, remove the jumper(s) shown in Figure 3.1 and Figure 3.2.

Figure 3.1 Typical Jumper Locations (1 to 20 HP)



Jumper	Removes	HP
JP3 – JP2	MOV to Ground	1 to 20
JP3B – JP3A	Common Mode Capacitors to Ground	5 to 10 @ 208V 7.5 to 20 @ 460V

Figure 3.2 Typical Jumper Locations (25 HP and Larger)



Jumper	Component	HP	Action
PEA	Common Mode Capacitors	25 to 50	Remove jumper
		60 to 150	Remove the I/O Cassette. The green/yellow jumper is located on the back of the chassis in the area shown. Disconnect, insulate, and secure the wire to guard against unintentional contact with chassis or components.
PEB	MOVs	25 to 50	Remove jumper
		75 to 150	Note location of green/yellow jumper wire. Disconnect, insulate and secure the wire guard against unintentional contact with chassis or components.

Input Power Conditioning

If any of the following conditions exist, the use of an isolation transformer is recommended.

- Frequent power outages
- Ungrounded AC supply source
- Facility has power factor correction capacitors

- Input voltage variations exceed drive operating specifications

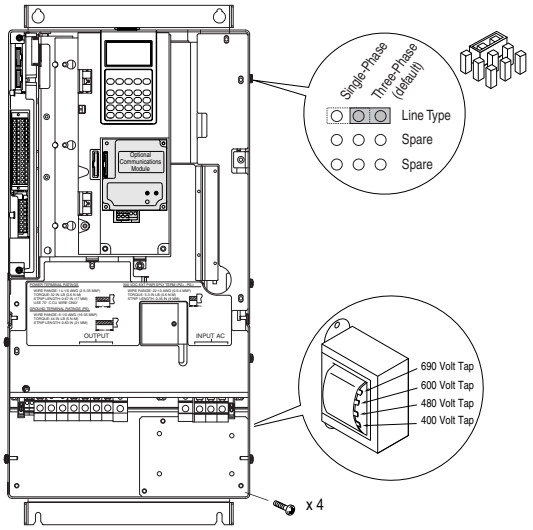
AC Input Phase Selection (60 HP and Larger)

Move the “Line Type” jumper as shown in figure Figure 3.3 to select single- or three-phase operation.

Selecting/Verifying Fan Voltage (60 HP and Larger)

Drives rated 60 HP and larger use a transformer to match the input line voltage to the internal fan voltage. If your line voltage is different than the voltage class specified on the drive nameplate, it will be necessary to change the transformer tap as shown in figure Figure 3.3 .

Figure 3.3 Selecting Input Phase and Fan Voltage (60 HP and Larger)



Making Sure Environmental Conditions are Met

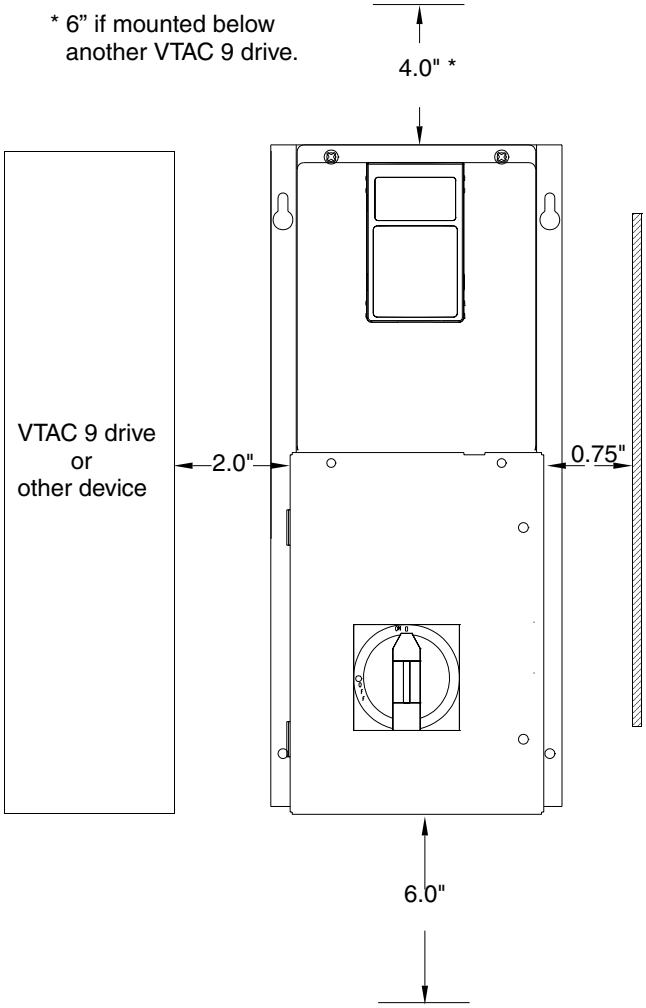
Before deciding on an installation site, consider the following guidelines:

- Verify that NEMA 1 drives can be kept clean, cool, and dry.
- The area chosen should allow the space required for proper air flow as defined on page 3-3.
- Be sure that NEMA 1 drives are away from oil, coolants, or other airborne contaminants.
- Do not install the drive more than 3300 feet above sea level without derating output power. For every 300 feet above 3300 feet, derate the output current 1%.
- Verify that the drive location will meet the environmental conditions in Appendix A.

Verifying the Site Provides for Recommended Air Flow Clearances

Be sure there is adequate clearance for air circulation around the drive. For best air movement, do not mount VTAC 9 drives directly above each other. Note that no devices are to be mounted behind the drive. This area must be kept clear of all control and power wiring. See Figure 3.4 for recommended air flow clearances.

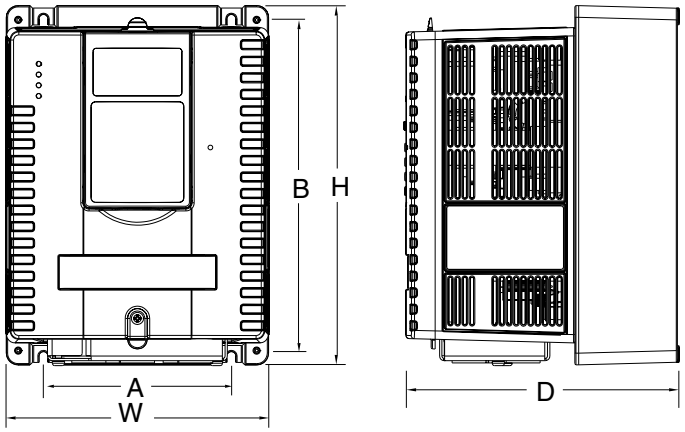
Figure 3.4 Minimum Mounting Clearances



Determining the Total Area Required for the Drive

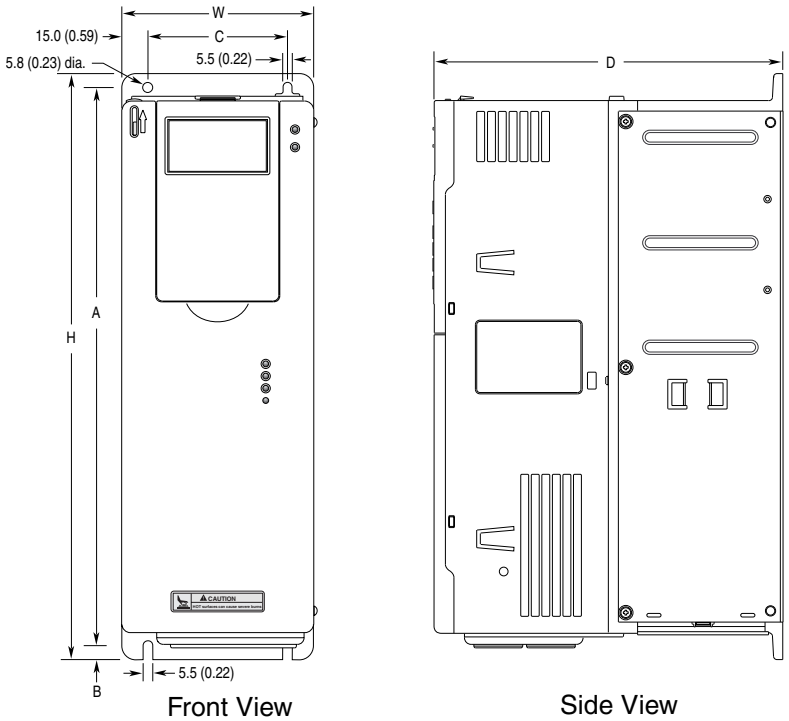
Overall dimensions and weights are illustrated in Figure 3.5 to Figure 3.12 as an aid to calculating the total area required by the VTAC 9 drive.

Figure 3.5 Wall Mounted Drive-Only Dimensions - 1 to 20 HP



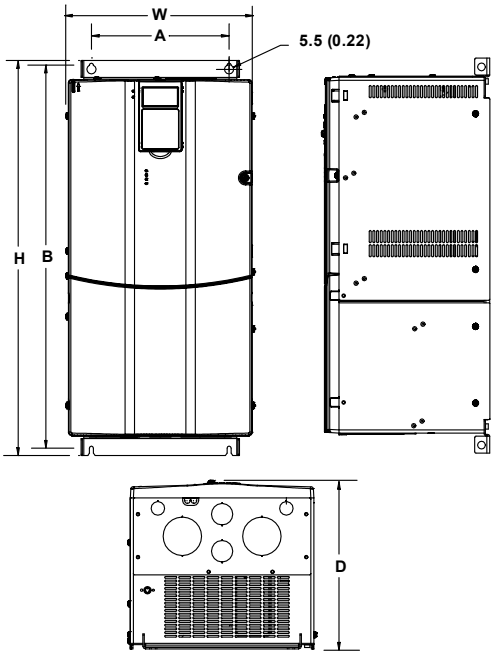
HP	H (in)	W (in)	D (in)	A (in)	B (in)	Weight (lb)
1 to 3 @ 208V AC 1 to 5 @ 480V AC	9.24	6.74	7.08	4.83	8.67	10
5 @ 208V AC 7.5 to 10 @ 480V AC	11.81	7.32	7.08	5.42	11.25	17
7.5 to 10 @ 208V AC 15 to 20 @ 480V AC	13.78	8.86	7.10	6.65	13.21	21.5

Figure 3.6 Wall Mounted Drive-Only Dimensions - 25 to 50 HP



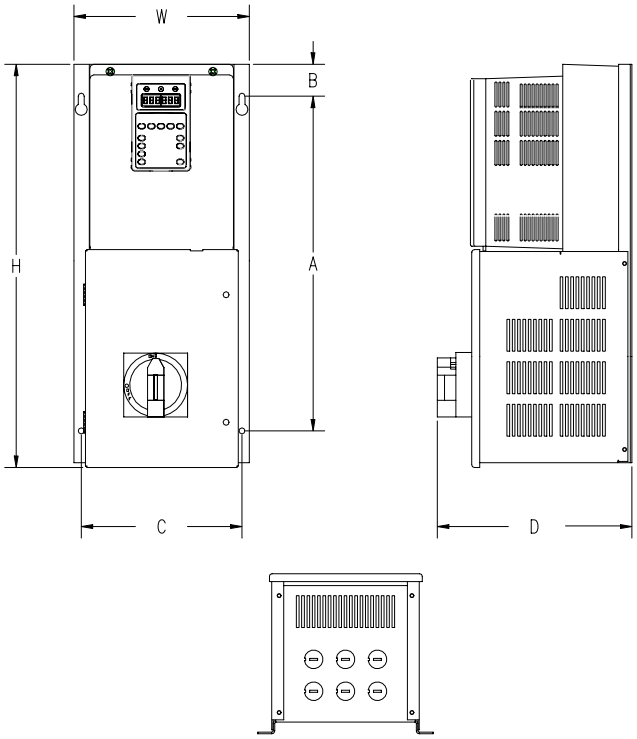
HP	H (in)	W (in)	D (in)	A (in)	C (in)	Weight (lb)
25 @ 460V AC	13.48	8.74	7.87	12.6	7.56	27.6
30 to 50 @ 460V AC	20.37	8.74	7.87	19.69	7.56	40.9

Figure 3.7 Wall-Mounted Drive-Only Dimensions - 60 to 150 HP



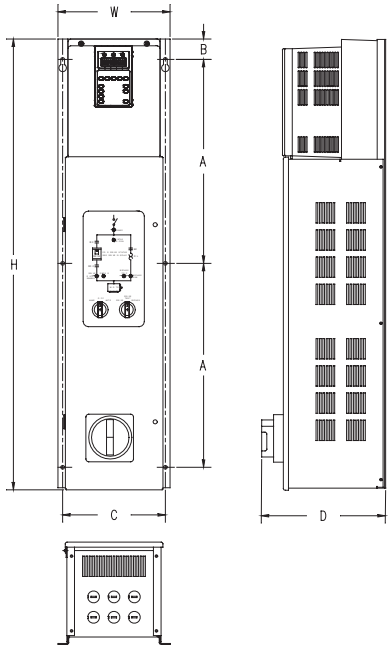
HP	H (in)	W (in)	D (in)	B (in)	A (in)	Weight (lb)
60 to 75 HP @ 460V AC	25.37	12.16	10.84	24.61	8.86	82.0
100 HP @460V AC	27.18	12.16	10.84	24.61	8.86	82.0
125 to 150 HP @ 460V AC	38.44	15.90	10.85	32.48	11.81	93.0

Figure 3.8 Wall-Mounted Drive with Style A Option Dimensions



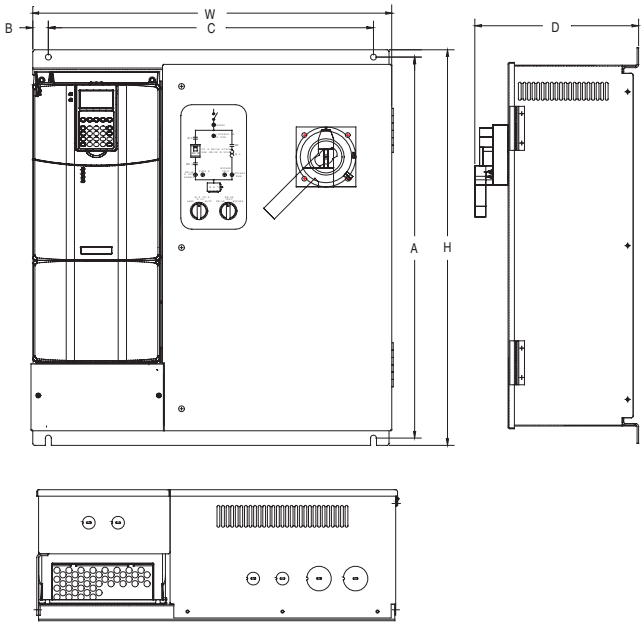
HP	H (in)	W (in)	D (in)	A (in)	B (in)	C (in)	Weight (lb)
1 to 3 @ 208V AC 1 to 5 @ 480V AC	18.97	8.25	9.16	15.75	1.50	7.56	21
5 @ 208V AC 7.5 to10 @ 480V AC	23.72	8.94	9.22	20.75	1.50	8.25	31
7.5 to10 @ 208V AC 15 to 20 @ 480V AC	29.00	10.88	9.34	25.75	1.50	9.88	39.5
25 @ 460V AC	29.00	10.88	10.22	25.75	1.50	9.88	48
30 to 50 @ 460V AC	35.88	11.88	10.75	32.75	1.50	10.88	69
60 to 100 @ 460V AC	43.14	17.00	13.81	15.75	1.50	15.50	150
125 to 150 @ 460V AC	50.00	35.00	13.959	48.50	0.75	30.00	389

Figure 3.9 Wall-Mounted Drive with Style B Option Dimensions - 1 to 25 HP



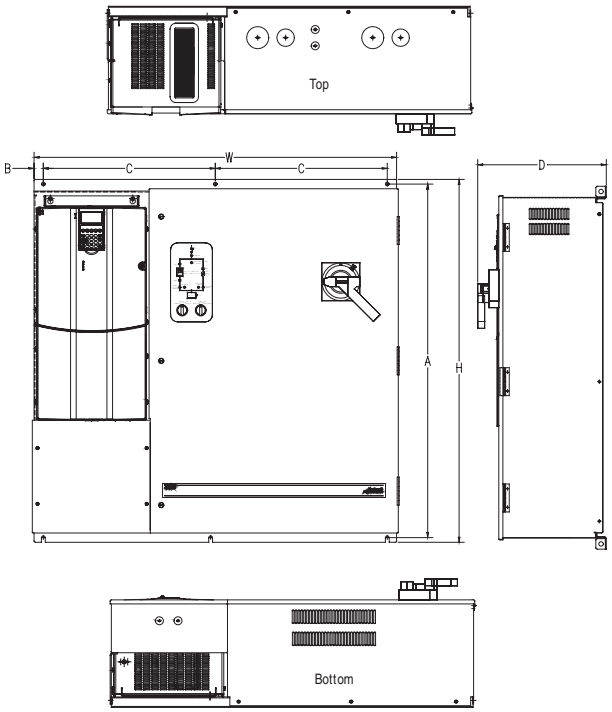
HP	H (in)	W (in)	D (in)	A (in)	B (in)	C (in)	Weight (lb)
1 to 3 @ 208V AC 1 to 5 @ 480V AC	33.16	8.25	9.16	15.00	1.50	7.56	35
5 @ 208V AC 7.5 to 10 @ 480V AC	37.00	8.94	9.22	17.00	1.50	8.25	47
7.5 to 10 @ 208V AC 15 to 20 @ 480V AC	43.19	10.88	9.34	20.00	1.50	9.88	60
25 @ 460V AC	43.19	10.88	10.22	20.00	1.50	9.88	68

Figure 3.10 Wall-Mounted Drive with Style B Option Dimensions - 30 to 50 HP



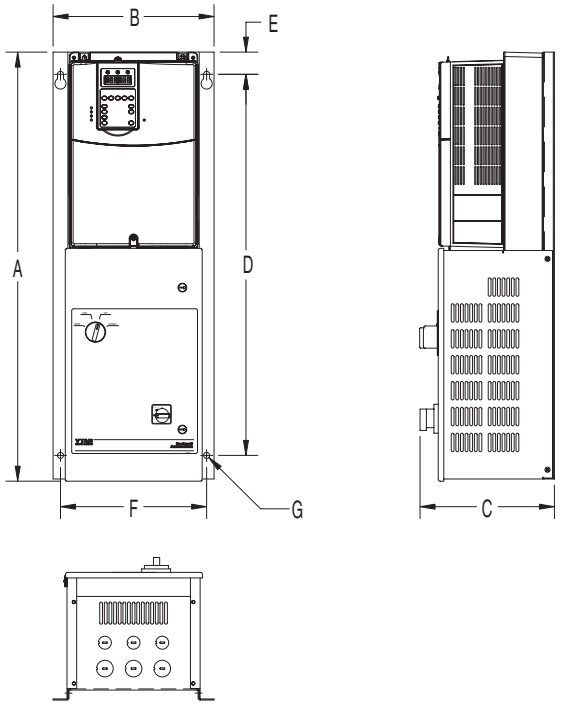
HP	H (in)	W (in)	D (in)	A (in)	B (in)	C (in)	Weight (lb)
30 to 50 @ 480V AC	27.0	24.66	11.25	26.0	0.50	22.25	95

Figure 3.11 Wall-Mounted Drive with Style B Option Dimensions - 60 to 150 HP



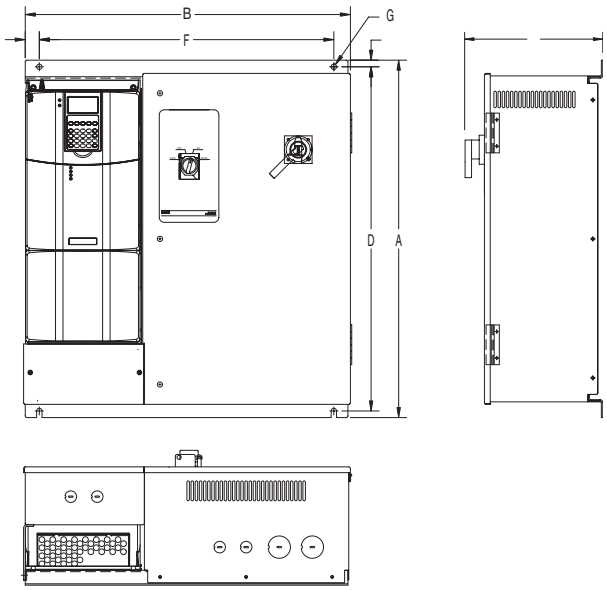
HP	H (in)	W (in)	D (in)	A (in)	B (in)	C (in)	Weight (lb)
60 to 100 @ 460V AC	41.0	39.0	13.8	38.0	1.0	18.5	(60 HP) 240 (75 HP) 250 (100 HP) 270
125 to 150 @ 460V AC	50.00	43.5	13.96	48.5	2.5	19.25	419

Figure 3.12 Wall-Mounted Drive with Style M Option Dimensions - 1 to 25 HP



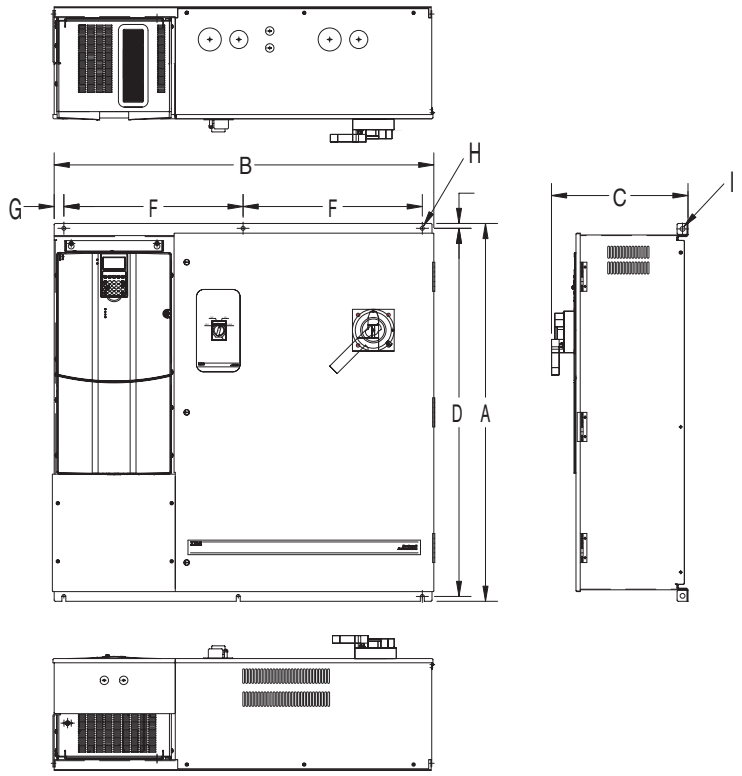
HP	A (in)	B (in)	C (in)	D (in)	E (in)	F (in)	Weight (lb)
1 to 3 @ 208V AC 1 to 5 @ 480V AC	29.0	10.88	9.25	25.75	1.5	9.88	30.0
5 @ 208V AC 7.5 to 10 @ 480V AC	29.0	10.88	9.25	25.75	1.5	9.88	37.0
7.5 to 10 @ 208V AC 15 to 20 @ 480V AC	29.0	10.88	9.25	25.75	1.5	9.88	47.0
25 @ 480V AC	29.0	10.88	10.95	25.75	1.5	9.88	53.0

Figure 3.13 Wall-Mounted Drive with Style M Options Dimensions - 30-50 HP



HP	A (in)	B (in)	C (in)	D (in)	E (in)	F (in)	Weight (lb)
30 to 50 @480V AC	27.0	24.66	10.44	26.0	0.5	22.25	95

Figure 3.14 Wall-Mounted Drive with Style M Options Dimensions - 60-100 HP

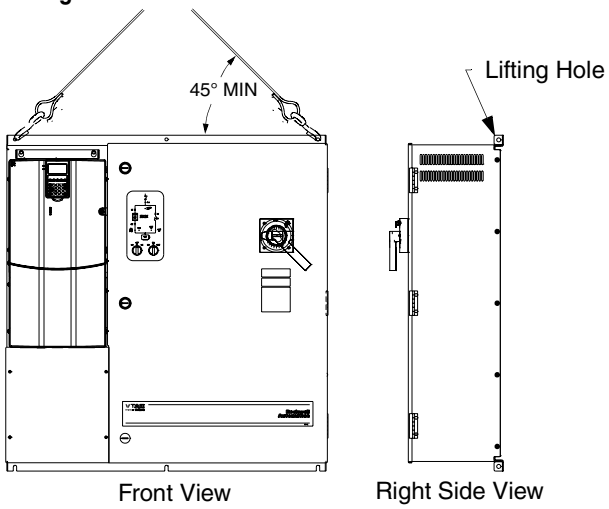


HP	A (in)	B (in)	C (in)	D (in)	E (in)	F (in)	Weight (lb)
60 @480V AC	41.00	39.00	12.98	40.00	0.50	18.50	240
75 @480V AC	41.00	39.00	12.98	40.00	0.50	18.50	250
100 @480V AC	41.00	39.00	12.98	40.00	0.50	18.50	270

Lifting and Mounting the Drive

Care should be used to prevent damage due to dropping or jolting when moving the drive. A fork lift truck or similar means of lifting and transporting may be used. Sling in a manner that will equalize the load at the pickup points. Use a spreader bar if the angle of the sling is less than 45 degrees relative to horizontal. Do not jolt while lifting.

Figure 3.15 Lifting the Drive



Use the following procedure to lift and mount the VTAC 9 drive:

Step 1. Attach a sling with safety hooks or clevis clamps to the two lifting holes. Make certain that the angle of the sling is not less than 45 degrees relative to horizontal (See Figure 3.15).

Step 2. Using an overhead or portable hoist, attach a free-fall chain to the chain secured to the drive. Take up any vertical slack in the chain.

Step 3. Using the hoist, lift the drive from the horizontal shipping pallet.

Step 4. Position the drive.

Step 5. Attach the drive to a vertical surface using the mounting holes provided. Use washers under the bolt heads.

Drives rated from 1 to 10 HP (1 to 5 HP @ 208V AC) should be mounted using 5/16” (M8) bolts.

Drives rated from 15 to 150 HP (7.5 to 10 HP @ 208V AC) should be mounted using 5/16” (M8) bolts.

Wiring Requirements for the Drive

ATTENTION: The user is responsible for conforming with all applicable local, national, and international codes. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

Evaluate wire sizes, branch circuit protection, and E-stop wiring (see Chapter 7) before continuing with the drive installation.

Meeting Terminal Block Input and Output Specifications

Drive Only

The terminal block on the VTAC 9 Main Control board provides terminals for 24 VDC power for the remote control inputs. Refer to Table 4.C for control input and output wire specifications.

Drive with Options

The terminal block in the options cabinet provides terminals for 115 VAC power for the remote control inputs. The options cabinet terminal block is factory-wired to the terminal block on the VTAC 9 Main Control board. Refer to Table 4.B for control input and output wire specifications.

Determining Wire Size Requirements

Wire size should be determined based on the size of conduit openings, and applicable local, national, and international codes, such as NEC/CEC.

Power Wiring

ATTENTION: National codes and standards (NEC, VDE, BSI, etc.) and local codes outline provisions for safely installing electrical equipment. Installation must comply with specifications regarding wire types, conductor sizes, branch circuit protection, and disconnect devices. Failure to do so may result in personal injury and/or equipment damage.

Cable Types Acceptable for 200-600 Volt Installations

General

A variety of cable types are acceptable for drive installations. For many installations, unshielded cable is adequate, provided it can be separated from sensitive circuits. As an approximate guide, allow a spacing of 0.3 meters (1 foot) for every 10 meters (32.8 feet) of length. In all cases, long parallel runs must be avoided. Do not use cable with an insulation thickness less than or equal to 15 mils (0.4 mm/0.015 in). See Table 4.A.

Unshielded

THHN, THWN or similar wire is acceptable for drive installation in dry environments provided adequate free air space and/or conduit fill rates limits are provided. Do not use THHN or similarly coated wire in wet areas. Any wire chosen must have a minimum insulation thickness of 15 mils and should not have large variations in insulation concentricity.

Shielded/Armored Cable

Shielded cable is recommended if sensitive circuits or devices are connected or mounted to the machinery driven by the motor.

Table 4.A Recommended Shielded Wire

Location	Rating/Type	Description
Standard (Option 1)	600V, 90°C (194°F) XHHW2/RHW-2 Anixter B209500-B209507, Belden 29501-29507, or equivalent	• Four tinned copper conductors with XLP insulation. • Copper braid/aluminum foil combination shield and tinned copper drain wire. • PVC jacket.
Standard (Option 2)	Tray rated 600V, 90° C (194° F) RHH/RHW-2 Anixter OLF-7xxxxx or equivalent	• Three tinned copper conductors with XLPE insulation. • 5 mil single helical copper tape (25% overlap min.) with three bare copper grounds in contact with shield. • PVC jacket.
Class I & II; Division I & II	Tray rated 600V, 90° C (194° F) RHH/RHW-2 Anixter 7V-7xxxx-3G or equivalent	• Three bare copper conductors with XLPE insulation and impervious corrugated continuously welded aluminum armor. • Black sunlight resistant PVC jacket overall. • Three copper grounds on #10 AWG and smaller.

Terminal Block Wire Size Ranges and Torque

Input power wiring should be sized according to applicable codes to handle the drive's continuous-rated input current. Output wiring should be sized according to applicable codes to handle the drive's continuous-rated output current. See Table 4.B for the range of power wire sizes that the terminals can accomodate.

Table 4.B Terminal Block Specifications

Name	Style	HP	Wire Size Range[1]		Torque (in-lb)
			Minimum	Maximum	
Input Power L1(R), L2(S), L3(T)	Drive Only	1 to 10 @ 480 V 1 to 5 @ 208 V	14 AWG	12 AWG	5
		15 to 20 @ 480 V 7.5 to 10 @ 208 V	14 AWG	8 AWG	12
		25 @ 480 V	14 AWG	6 AWG	12 to 15
		30 to 50 @ 480 V	14 AWG	3 AWG	16 to 32
		60 to 75 @ 480 V	14 AWG	1/0 AWG	32
		100 @ 480 V	4 AWG	3/0 AWG	133
		125 to 150 @ 480V	14 AWG	250 MCM	52
	A, B	1 to 10 @ 480 V 1 to 5 @ 208 V	14 AWG	8 AWG	35
		15 to 25 @ 480 V 7.5 to 10 @ 208 V	14 AWG	4 AWG	35
		30 to 50 @ 480 V	14 AWG	2 AWG	155
		60 to 150 @ 480 V	(2) 1/0 AWG	350 KCMIL	275

Name	Style	HP	Wire Size Range[1]		Torque (in-lb)
			Minimum	Maximum	
Output Power T1(U), T2(V), T3(W)	Drive Only	1 to 10 @ 480 V 1 to 5 @ 208 V	14 AWG	12 AWG	5
		15 to 20 @ 480 V 7.5 to 10 @ 208 V	14 AWG	8 AWG	12
		25 @ 480 V	14 AWG	6 AWG	12
		30 to 50 @ 480 V	14 AWG	3 AWG	16
		60 to 75 @ 480 V	14 AWG	1/0 AWG	32
		100 @ 480 V	4 AWG	3/0 AWG	133
		125 to 150 @ 480V	14 AWG	250 MCM	52
	A	1 to 10 @ 480 V 1 to 5 @ 208 V	14 AWG	12 AWG	16
		15 to 25 @ 480 V 7.5 to 10 @ 208 V	14 AWG	8 AWG	30
		30 to 50 @ 480 V	12AWG	1/0 AWG	50
		60 to 75 @ 480 V	14 AWG	1/0 AWG	22
		100 @ 480 V	6 AWG	350 KCMIL	275
		125 to 150 @ 480 V	14 AWG	250 MCM	52
	B	1 to 10 @ 480 V 1 to 5 @ 208 V	14 AWG	8 AWG	13
		15 to 25 @ 480 V 7.5 to 10 @ 208 V	14 AWG	4 AWG	20
		30 to 50 @ 480 V	12 AWG	1/0 AWG	22
		60 to 75 @ 480 V	14 AWG	1/0 AWG	22
		100 @ 480 V	6 AWG	350 KCMIL	275
		125 to 150 @ 480 V	6 AWG	350 KCMIL	275

(1) Maximum/minimum sizes that the terminal block will accept. These are not recommendations.

Recommended Control and Signal Wire Sizes

The terminal block on the Main Control board provides terminals for 24 V DC power for the eight remote control inputs and outputs. The terminal block in the options cabinet provides terminals for 115 V AC power for the remote control inputs and outputs. The options cabinet terminal block is factory-wired to the terminal block on the VTAC 9 Main Control board. Refer to Table 4.C for signal and control wire specifications.

Table 4.C Recommended Signal and Control Wire

Signal Type	Wire Type(s)	Description	Minimum Insulation Rating
Analog I/O	Belden 8760/9460 (or equiv.)	18 AWG, twisted pair, 100% shield with drain[1].	300V, 167-194°F
	Belden 8770 (or equiv.)	18 AWG, 3-conductor, shielded for remote pot only.	
Unshielded Control	Per NEC or applicable local code		300V, 140°F
Shielded Control	Multi-conductor cable such as Belden 8770 (or equiv.)	100% shield coverage copper, color-coded, and jacketed	300V, 140°F

(1) If the wires are short and contained within a cabinet that has no sensitive circuits, the use of shielded wire may not be necessary, but is always recommended.

Reflected Wave Compensation

The pulses from a pulse width modulation (PWM) inverter using IGBTs are very short in duration (50 nanoseconds to 1 millisecond). These short pulse times, combined with the fast rise times (50 to 400 nanoseconds) of the IGBT, may result in excessive overvoltage transients at the motor.

Voltages in excess of twice the DC bus voltage, (650V DC nominal @480V input) could result at the motor and can cause motor winding failure.

The patented reflected wave correction software in the VTAC 9 AC drive will reduce these overvoltage transients from the drive to the motor. The correction software modifies the PWM modulator to prevent PWM pulses less than a minimum time from being applied to the motor. The minimum time between PWM pulses is 10 microseconds. The modifications to the PWM modulator limit the overvoltage transient to 2.25 per unit volts line-to-line peak at 600 feet of cable.

400 V Line = 540V DC bus (max) x 2.25 = 1200 V
480 V Line = 715V DC bus (max) x 2.25 = 1600 V
600 V Line = 891V DC bus (max) x 2.25 = 2000 V

The reflected wave software can be disabled using paramter 56, Compensation.

Figure 4.1 Inverter and Motor Line-to-Line Voltages

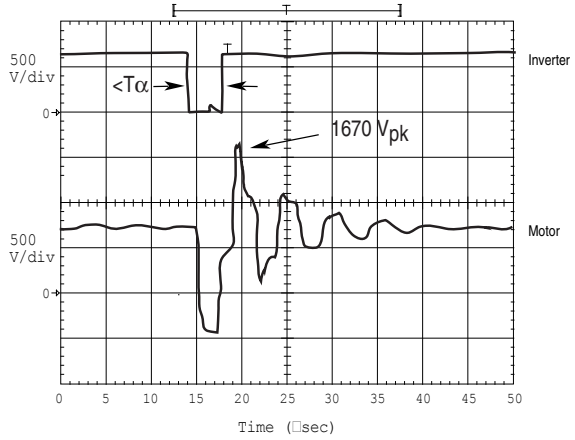


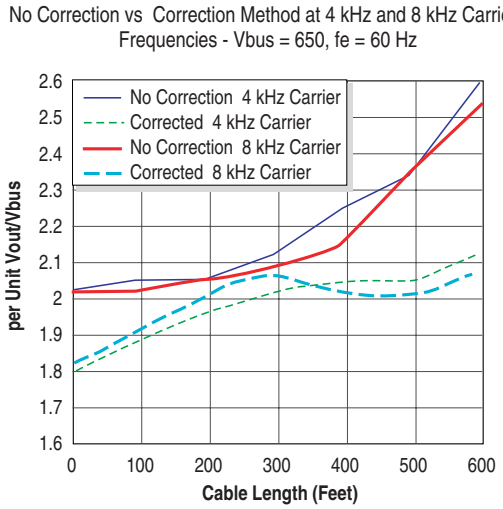
Figure 4.1 shows the inverter line-to-line output voltage (top trace) and the motor line-to-line voltage (bottom trace) for a 10 HP, 460V AC inverter, and an unloaded 10 HP AC induction motor at 60 Hz operation. 500 ft. of #12 AWG PVC cable connects the drive to the motor.

Initially, the cable is in a fully charged condition. A transient disturbance occurs by discharging the cable for approximately 4 ms. The propagation delay between the inverter terminals and motor terminals is approximately 1ms. The small time between pulses of 4ms does not provide sufficient time to allow the decay of the cable transient. Thus, the second pulse arrives at a point in the motor terminal voltage's natural response and excites a motor overvoltage transient greater than 2 pu.

The amplitude of the double pulsed motor over-voltage is determined by a number of variables. These include the damping characteristics of the cable, bus voltage, and the time between pulses, the carrier frequency, modulation technique, and duty cycle.

Figure 4.2 shows the per unit motor overvoltage as a function of cable length. This is for no correction versus the modulation correction code for varied lengths of #12 AWG PVC cable to 600 feet for a 4 kHz and 8 kHz carrier frequencies. The output line-to-line voltage was measured at the motor terminals in 100 feet increments.

Figure 4.2 Motor Overvoltage as a Function of Cable Length



Without the correction, the overvoltage increases to unsafe levels with increasing cable length for both carrier frequencies.

The patented modulation correction code reduces the over-voltage for both carrier frequencies and maintains a relatively flat overvoltage level for increasing cable lengths beyond 300 feet.

Recommended Motor Lead Lengths

To reduce line disturbances and noise, motor lead length should not exceed 200 feet for any non-Reliance Electric motor or any non-inverter duty motor.

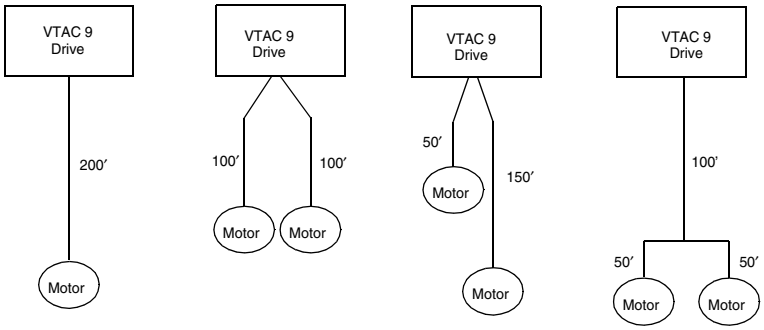
When total lead length exceeds 200 feet, nuisance trips can occur caused by capacitive current flow to ground. Note that these capacitively-coupled currents should be taken into consideration when working in areas where drives are running. If the motor lead length must exceed these limits, the addition of output line reactors (see Chapter 6) or other steps must be taken to avoid problems.

Your application may be restricted to a shorter lead length due to:

- the type of wire
- the placement of wire (for example, in conduit or a cable tray)
- the type of line reactor
- the type of motor.

Figure 4.3 illustrates how to calculate motor lead lengths. The examples shown assume a maximum lead length of 200 feet.

Figure 4.3 Calculating Motor Lead Lengths



Verifying Power Module Output Current Rating is Greater than Motor Full Load Amps

Verify that the VTAC 9 drive output current rating is greater than the motor's full load current (amps). Table 2.A lists the output current values.

Selecting Input Line Branch Circuit Fuses

ATTENTION: Most codes require that upstream branch circuit protection be provided to protect input power wiring. Install the fuses recommended in table 4.3. Do not exceed the fuse ratings. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

Input line branch circuit protection fuses must be used to protect the input power lines. If input fuses are not provided with your drive, recommended fuse values are shown in Table 4.D. The input fuse ratings listed are applicable for one drive per branch circuit. No other load may be applied to that fused circuit.

The recommended fuse type for all VTAC 9 drives is UL Class J, 600V, time delay.

Table 4.D AC Input Line Fuse Selection Values

Horsepower Rating (HP)	Input Voltage (V AC)	Fuse Rating (A)
1	208	10
	480	6
2	208	15
	480	10
3	208	20
	480	10
5	208	20
	480	15
7.5	208	35
	480	20
10	208	40
	480	20
15	480	35
20	480	35
25	480	60
30	480	70
40	480	80
50	480	100
60	480	150
75	480	175
100	480	200
125	480	250
150	480	350

Wire-Routing Locations and Grounding

This chapter shows entry areas where wiring is to be routed in and out of the drive and how to properly ground it.

Verifying the Drive's Watts Loss Rating

When mounting the drive inside another enclosure, determine the watts loss rating of the drive from Table 2.A. This table lists the typical full load power loss watts value under all operating carrier frequencies. Ensure that the enclosure is adequately ventilated with 32° to 104° F (0° to 40° C) ambient air.

Routing Input, Motor Output, Ground, and Control Wiring for the Drive

All wiring must be installed in conformance with applicable local, national, and international codes, such as NEC/CEC. Signal wiring, control wiring, and power wiring must be routed in separate conduits to prevent interference with drive operation.

Note that no wires are to be routed behind the drive. Use grommets, when hubs are not provided, to guard against wire chafing.

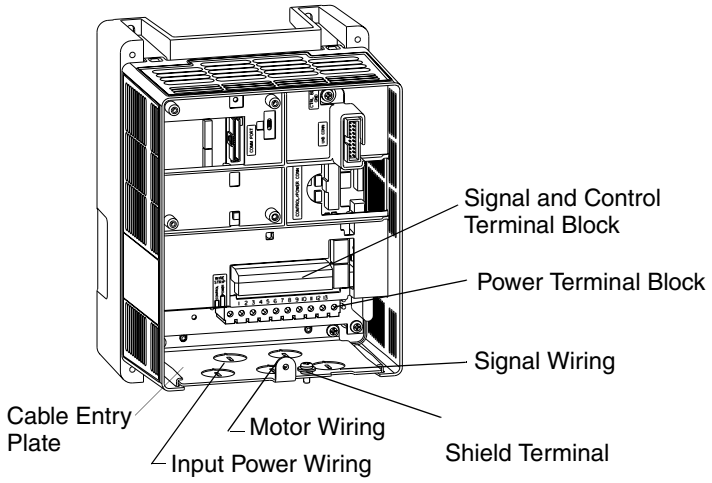
Figure 5.1 through Figure 5.4 show the wire routing, grounding terminal, signal and control terminal blocks, and power terminal blocks of the VTAC 9 drives.

ATTENTION: Do not route signal and control wiring with power wiring in the same conduit. This can cause interference with drive operation. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

Do not route more than three sets of motor leads through a single conduit. This will minimize cross-talk that could reduce the effectiveness of noise reduction methods. If more than three drive/motor connections per conduit are required, shielded cable must be used. If possible, each conduit should contain only one set of motor leads.

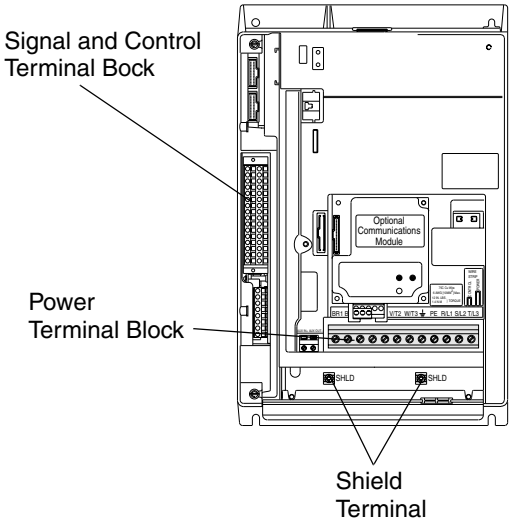
ATTENTION: Unused wires in conduit must be grounded at both ends to avoid a possible shock hazard caused by induced voltages. Also, if a drive sharing a conduit is being serviced or installed, all drives using this conduit should be disabled to eliminate the possible shock hazard from cross-coupled motor leads. Failure to observe these precautions could result in bodily injury.

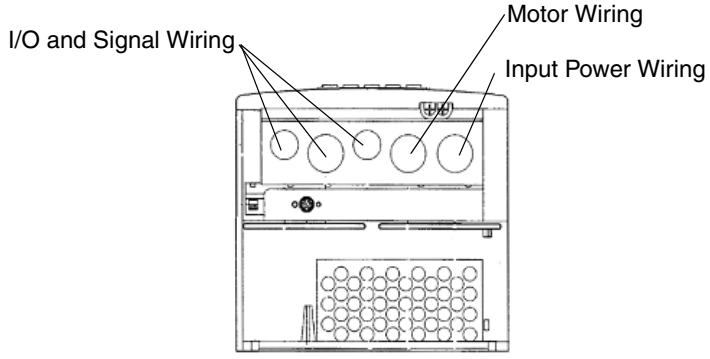
Figure 5.1 Wire Routing and Terminal Block Locations - Drive Only (1 to 20 HP)



(5 HP shown)

Figure 5.2 Wire Routing and Terminal Block Locations - Drive Only (25 to 50 HP)





(25 HP shown)

Figure 5.3 Wire Routing and Terminal Block Locations - Drive with Main Input Disconnect or Bypass (60 to 150HP)

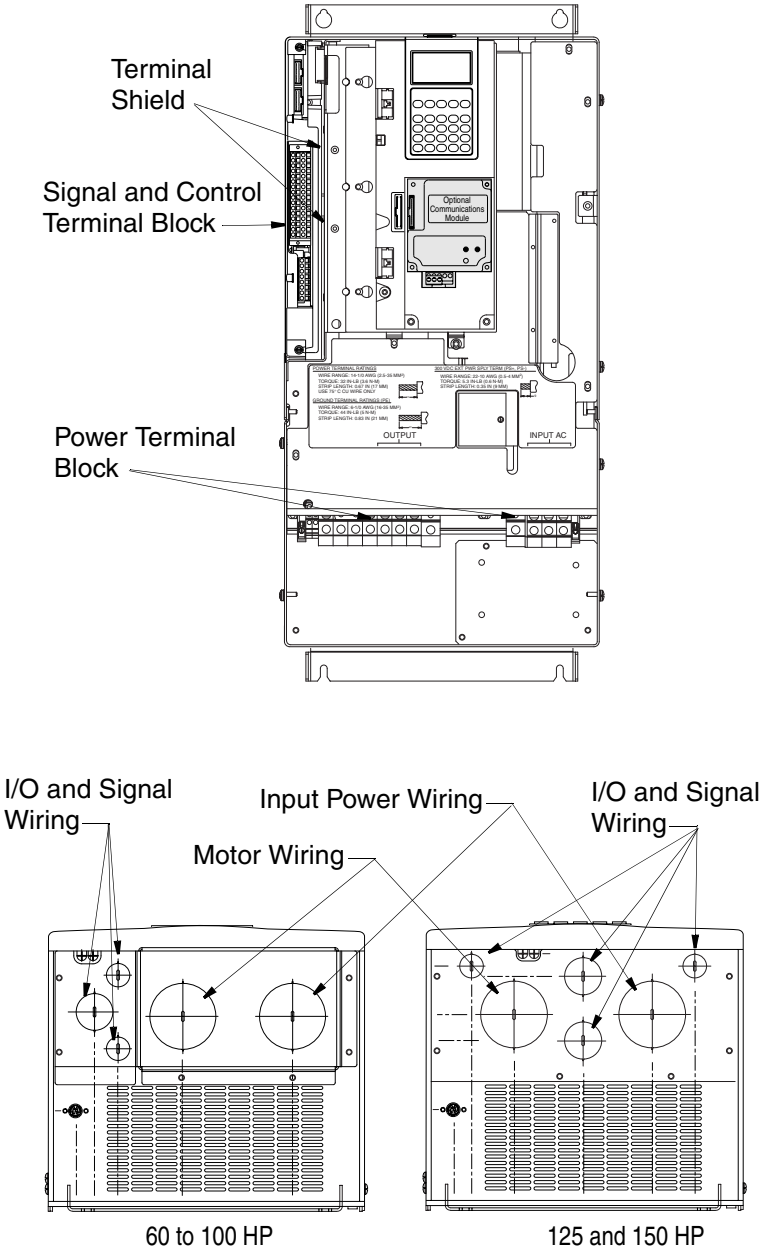


Figure 5.4 Wire Routing and Terminal Block Locations - Drive with Main Input Disconnect or Bypass (1 to 25 HP)

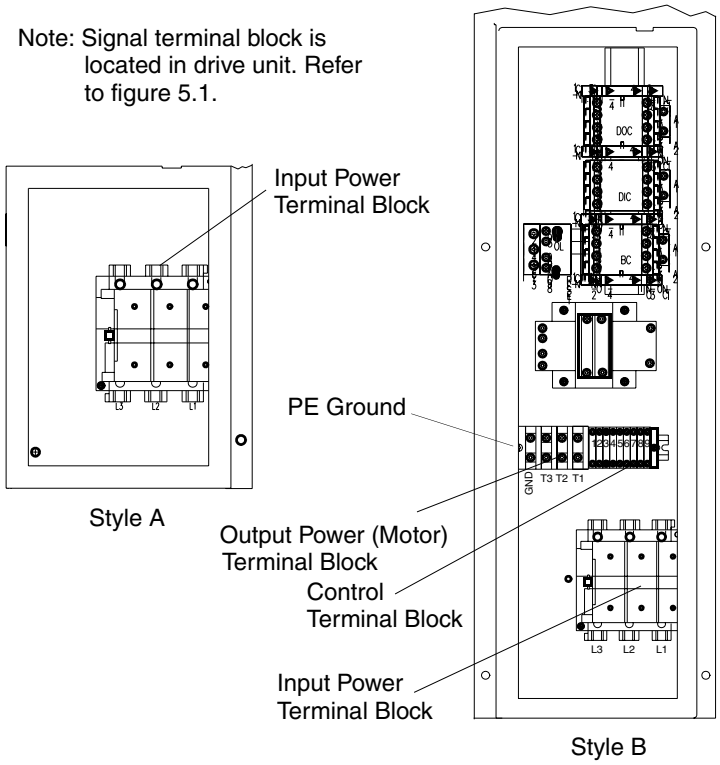

Note: Signal terminal block is located in drive unit. Refer to figure 5.1.
Input Power Terminal Block
PE Ground
Output Power (Motor) Terminal Block
Control Terminal Block
Input Power Terminal Block
Style A
Style B

Figure 5.5 Wire Routing and Terminal Block Locations - Drive with Main Input Disconnect or Bypass (30 to 50 HP)

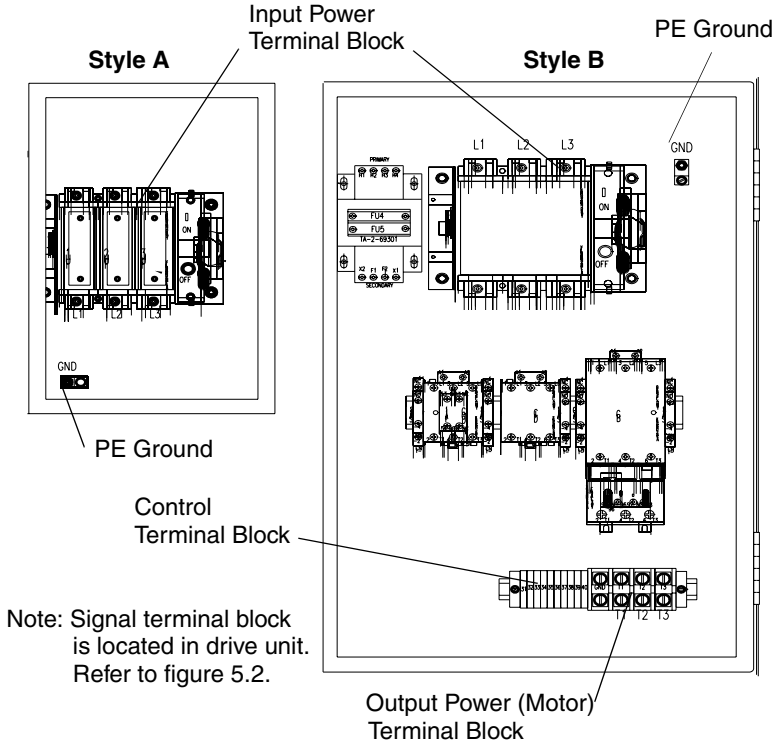
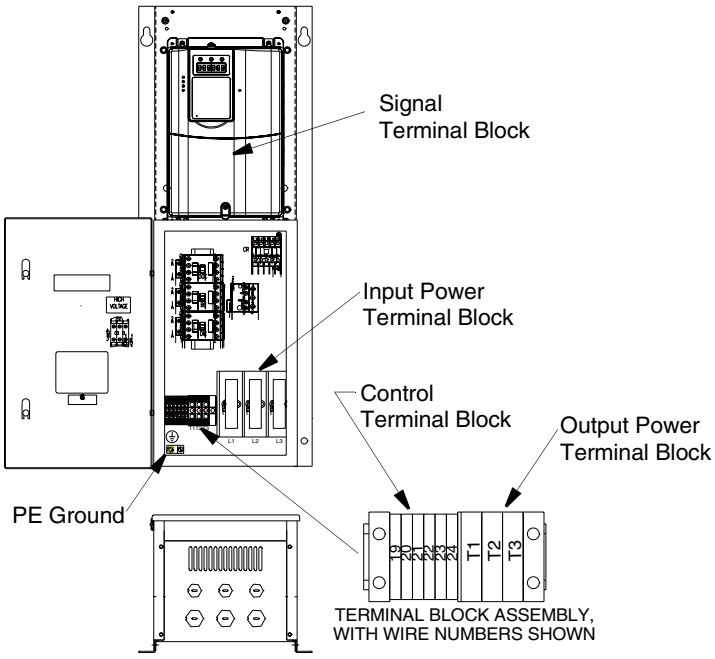
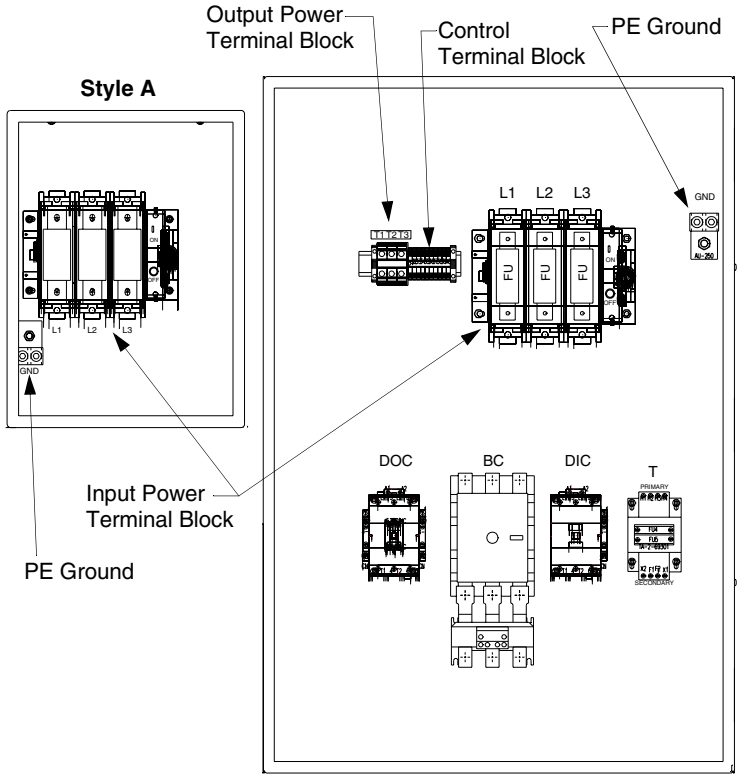

Input Power Terminal Block
PE Ground
Style A
Style B
PE Ground
Control Terminal Block
Note: Signal terminal block is located in drive unit. Refer to figure 5.2.
Output Power (Motor) Terminal Block

Figure 5.6 Wire Routing and Terminal Block Locations - Drive with Manual Bypass (60 to 150 HP)



Note: Signal terminal block is located in drive unit. Refer to figure 5.1.

Figure 5.7 Wire Routing and Terminal Block Locations - Drive with Manual Bypass (1 to 20 HP)



Note: Signal terminal block is located in drive unit. Refer to figure 5.3.

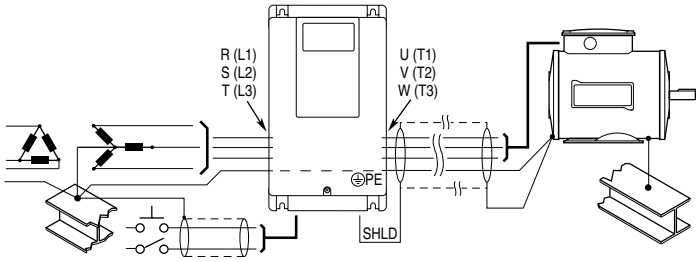
Grounding the Drive

ATTENTION: The user is responsible for conforming with all applicable local, national, and international codes. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

If the supply system is grounded, the drive Safety Ground - PE terminal must be connected to system ground. Ground impedance must conform to the requirements of national and local industrial safety regulations and/or electrical codes. The integrity of all ground connections should be periodically checked.

For installations within a cabinet, a single safety ground point or ground bus bar connected directly to building steel should be used. All circuits including the AC input ground conductor should be grounded independently and directly to this point/bar. See Figure 5.8 for grounding points.

Figure 5.8 Typical Grounding - Drive Only



Safety Ground - PE

This is the safety ground for the drive that is required by code. This point must be connected to adjacent building steel (girder, joist), a floor ground rod or bus bar. Grounding points must comply with national and local industrial safety regulations and/or electrical codes.

Shield Termination - SHLD

The SHLD terminal located on the Cable Entry Plate provides a grounding point for the motor cable shield. Refer to Figure 5.1 for location.

The motor cable shield connected to the SHLD terminal (drive end) should also be connected to the motor frame (motor end). Use a shield-terminating or EMI clamp to connect shield to this terminal.

When shielded cable is used for control and signal wiring, the shield should be grounded at the source end only, not at the drive end.

Installing Power Wiring

ATTENTION: The user is responsible for conforming with all applicable local and national codes. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

This chapter provides instructions on wiring motor overload protection and output wiring to the motor and installing AC input power wiring. Refer to Figure 6.3 for a description of the power terminal block.

Opening or Removing the Cover

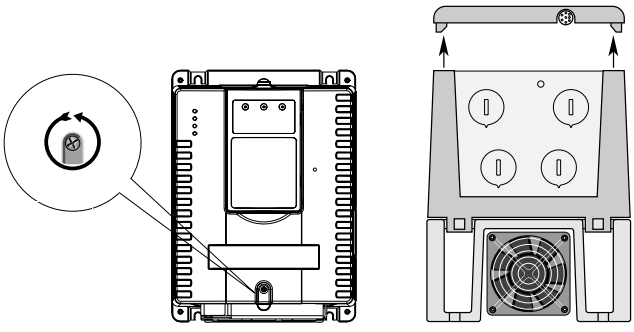
ATTENTION: DC bus capacitors retain hazardous voltages after input power has been removed. After disconnecting input power, wait five minutes for the DC bus capacitors to discharge and then check the voltage with a voltmeter to ensure the DC bus capacitors are discharged before touching any internal components. Failure to observe this precaution could result in severe bodily injury or loss of life.

Drives rated 1 to 20 HP have removable covers. Drives rated 25 to 150 HP have hinged covers.

Follow these steps for 1 to 20 HP drives:

- ❑ Step 1. **For drives with an options cabinet,** open the option cabinet door.
- ❑ Step 2. Loosen the drive cover screw (refer to Figure 6.1).
- ❑ Step 3. Lift the cover straight off the drive to avoid damaging the connector pins.

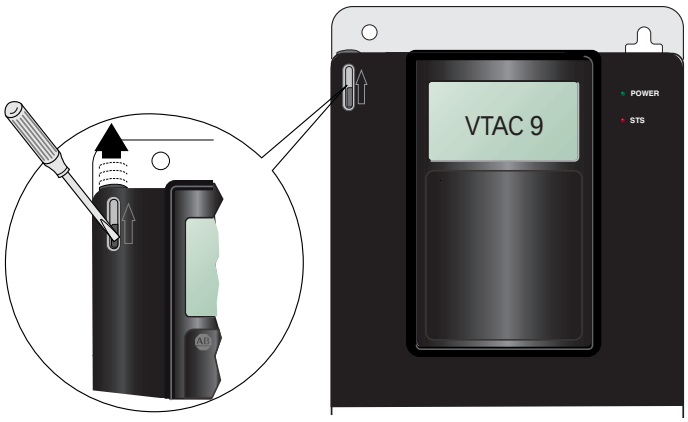
Figure 6.1 Removing the Drive Cover



Follow these steps for 25 to 150 HP drives:

- ❑ Step 1. **For drives with an options cabinet,** open the option cabinet door.
- ❑ Step 2. Locate the slot in the upper left hand corner of the drive (see Figure 6.2).
- ❑ Step 3. Slide the locking tab up and swing the door open.

Figure 6.2 Opening the Drive Cover (25 to 150 HP)



Installing Output Power Wiring

The following sections provide instructions on wiring output contactors, motor overload protection, and output wiring to the motor.

Installing Output Wiring from the Drive Output Terminals to the Motor – Drive Only

ATTENTION: Unused wires in conduit must be grounded at both ends to avoid a possible shock hazard caused by induced voltages. Also, if a drive sharing a conduit is being serviced or installed, all drives using this conduit should be disabled to eliminate the possible shock hazard from cross-coupled motor leads. Failure to observe these precautions could result in bodily injury.

ATTENTION: Do not route signal and control wiring with power wiring in the same conduit. This can cause interference with drive operation. Failure to observe these precautions could result in damage to, or destruction of, the equipment.

To connect the AC output power wiring from the drive to the motor:

❑ Step 1. Wire the three-phase AC output power motor leads by routing them according to drive type. See Figures 5.1, 5.2 and 5.3 for wire routing locations. Power wiring sizes are shown in Table 4.A.

Do not route more than three sets of motor leads through a single conduit. This will minimize cross-talk that could reduce the effectiveness of noise reduction methods. If more than three drive/motor connections per conduit are required, shielded cable must be used. If possible, each conduit should contain only one set of motor leads.

❑ Step 2. Connect the three-phase AC output power motor leads to terminals U/T1, V/T2, and W/T3 on the power terminal block.

❑ Step 3. Tighten the three-phase AC output power terminals to the proper torque according to drive type as shown in Table 6.A.

Installing Output Wiring from Drive Output Terminals to the Motor - Drive with Options

ATTENTION: Unused wires in conduit must be grounded at both ends to avoid a possible shock hazard caused by induced voltages. Also, if a drive sharing a conduit is being serviced or installed, all drives using this conduit should be disabled to eliminate the possible shock hazard from cross-coupled motor leads. Failure to observe these precautions could result in bodily injury.

ATTENTION: Do not route signal and control wiring with power wiring in the same conduit. This can cause interference with drive operation. Failure to observe these precautions could result in damage to, or destruction of, the equipment.

To connect the AC output power wiring from the drive to the motor:

❑ Step 1. Wire the three-phase AC output power motor leads by routing them according to the drive option type. See Figures 5.4, 5.5, or 5.6 for wire routing locations. Note that you must punch openings in the option cabinet of the desired conduit size, following NEC and all applicable local codes and standards.

Power wiring sizes are shown in Table 4.A.

Do not route more than three sets of motor leads through a single conduit. This will minimize cross-talk that could reduce the effectiveness of noise reduction methods. If more than three drive/motor connections per conduit are required, shielded cable must be used. If possible, each conduit should contain only one set of motor leads.

❑ Step 2. Connect the three-phase AC output power motor leads to terminals U/T1, V/T2, W/T3 on the power terminal block located in the options cabinet.

❑ Step 3. Tighten the three-phase AC output power terminals to the proper torque according to drive type as shown in Table 6.A.

Table 6.A Ouput Power Terminal Tightening Torque

	Maximum Tightening Torque	
Horsepower	**Drive Only**	**Drive with Options**
3 to 5 HP @ 208V AC 5 to 10 HP @ 460V AC	5 in-lb	12 to 13 in-lb
15 HP @ 460V AC		
7.5 to 10 HP @ 208V AC 20 HP @ 460V AC	12 in-lb	18 to 20 in-lb
25 to 30 HP @ 460V AC		
40 to 50 HP @ 460V AC	16 in-lb	22 in-lb
60 to 75 HP @ 460V AC	133 in-lb	22 in-lb
100 HP @ 460V AC	133 in-lb	275 in-lb
125 to 150 HP @ 460V AC	52 in-lb	275 in-lb

Installing Input Wiring

The following sections describe incoming line components and how to install them. Note that fuses and an input disconnect are also available as factory-installed options.

Installing an Optional Transformer or Reactor

Input isolation transformers might be needed to help eliminate:

- Damaging AC line voltage transients from reaching the drive.
- Line noise from the drive back to the incoming power source.
- Damaging currents that could develop if a point inside the drive becomes grounded.

Observe these guidelines when installing an isolation transformer:

- A power disconnecting device must be installed between the power line and the primary of the transformer.
- If the user-installed power disconnecting device is a circuit breaker, the circuit breaker trip rating must be coordinated with the in-rush current (10 to 12 times full load current) of the transformer.
- Do not use an input isolation transformer rated more than 1000 kVA for 480 V AC (500 kVA for 208 V AC) with less than 5% impedance directly ahead of the drive without additional impedance between the drive and the transformer.

Table 6.B shows recommended inductance and line reactor ratings.

Table 6.B AC Line Reactors

Drive (HP)	Line Reactor Inductance (±10%)
2-3	6.5 mH
5	3.0 mH
7.5	2.5 mH
10	1.5 mH
15	1.2 mH
20	0.8 mH
25	0.8 mH
30	0.7 mH
40	0.5 mH
50 to 60	0.4 mH
75	0.3 mH
100	0.2 mH
125	0.15 mH
150	0.11 mH

Installing Fuses for Branch Circuit Protection

If they were not installed as a factory option, install the required branch circuit protection fuses according to the applicable local, national, and international codes (such as NEC/CEC). The fuses must be installed in the line before the drive input terminals. Fuse values are provided in Table 4.D.

ATTENTION: Most codes require that upstream branch protection be provided to protect input power wiring. Failure to observe this precaution could result in severe bodily injury or loss of life.

Installing the Required External/Separate Input Disconnect

An input disconnect must be installed in the line before the drive input terminals in accordance with local, national, and international codes, such as NEC/CEC. If an input disconnect is not installed as a factory option, the disconnect should be sized according to the in-rush current as well as any additional loads the disconnect might supply. The trip rating for the in-rush current (10 to 12 times full load current) should be coordinated with that of the input isolation transformer, if used.

Installing Power Wiring from the AC Line to the Drive's Input Power Terminals

ATTENTION: Protect the contents of the options cabinet from metal chips and other debris while drilling the conduit openings. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

ATTENTION: Do not route signal and control wiring with power wiring in the same conduit. This can cause interference with drive operation. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

To connect AC input power to the drive:

❑ Step 1. Wire the AC input power leads by routing them according to drive type. Refer to Figures 5.1 through 5.4. Power wiring sizes are listed in Table 4.A.

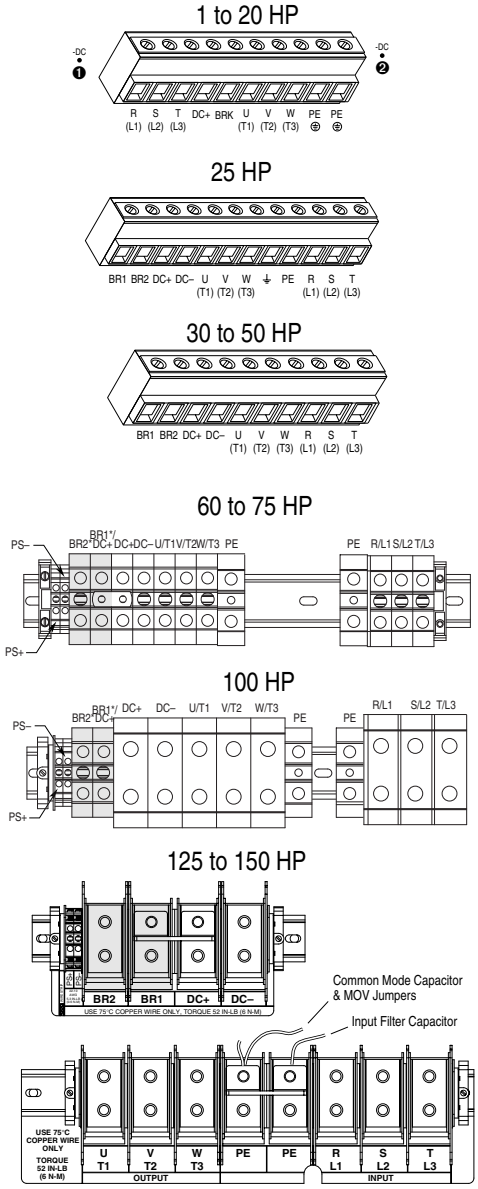
❑ Step 2. Connect the three-phase AC input power leads (three-wireV AC) to the appropriate terminals. Connect the AC input power leads to terminals R/L1, S/L2, T/L3 on the power terminal block.

❑ Step 3. Tighten the AC input power terminals to the proper torque according to drive type as shown in Table 6.C.

Table 6.C Input Power Terminal Tightening Torque

	Maximum Tightening Torque	
HP	**Drive Only**	**Drive with Options**
1 to 5 @ 208 V 1 to 10 @ 480 V	5 in-lb	35 in-lb
7.5 to 10 @ 208 V 15 to 25 @ 480 V	12 in-lb	35 in-lb
30 to 50 @ 480 V	16 to 32 in-lb	155 in-lb
60 to 150 @ 480 V	133 in-lb	275 in-lb

Figure 6.3 Power Terminal Block - Drive Unit



Refer to Table 6.D for terminal descriptions.

Figure 6.4 Power Terminal Block - Main Input Disconnect and Bypass Unit

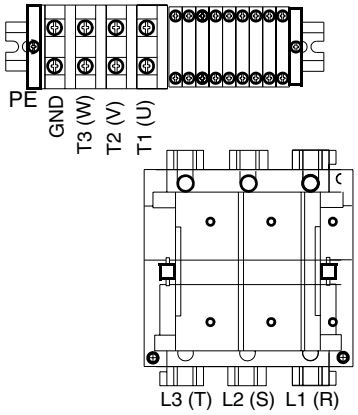


Table 6.D Power Terminal Descriptions

Terminal	Description	Notes
R	R (L1)	AC line input power
S	S (L2)	AC line input power
T	T (L3)	AC line input power
U	U (T1)	Output to Motor
V	V (T2)	Output to Motor
W	W (T3)	Output to Motor
PE	PE Ground	Earth Ground
❶[1]	-DC	DC bus test point (B-frame drives)
❷[1]	-DC	DC bus test point (C- and D-frame drives)
DC+[(1)]	DC Bus	DC bus test point (B-, C-, and D-frame drives)
BRK[1,(2)]	DC Brake	Dynamic brake resistor connection (–)
DC+[(3)]	DC Bus (+)	DC bus test point (+)
DC–[3]	DC Bus (–)	DC bus test point (–)
BR1[2,3]	DC Brake	Dynamic brake resistor connection (+)
BR2[2,3]	DC Brake	Dynamic brake resistor connection (–)

(1) 1 to 20 HP only.

(2) Contact Rockwell Automation Technical Support for recommended DC brake resistor circuit diagram prior to adding external DB resistors to VTAC 9 drives.

(3) 25 to 150 HP only.

Figures 6.5 through 6.8 illustrate the various wiring schematics for drive only, style A, style B, and style M installations.

Figure 6.5 VTAC 9 Wiring Schematic - Drive Only

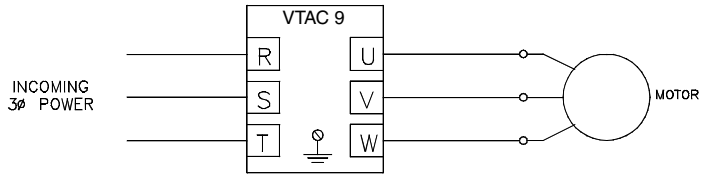


Figure 6.6 VTAC 9 Wiring Schematic - Style A

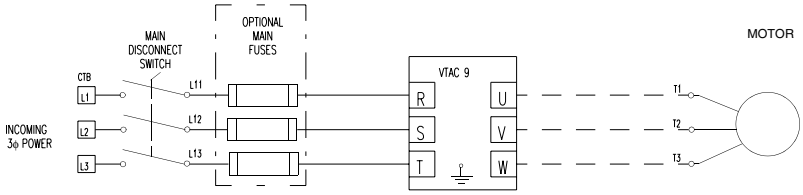


Figure 6.7 VTAC 9 Factory Wiring Schematic - Style B

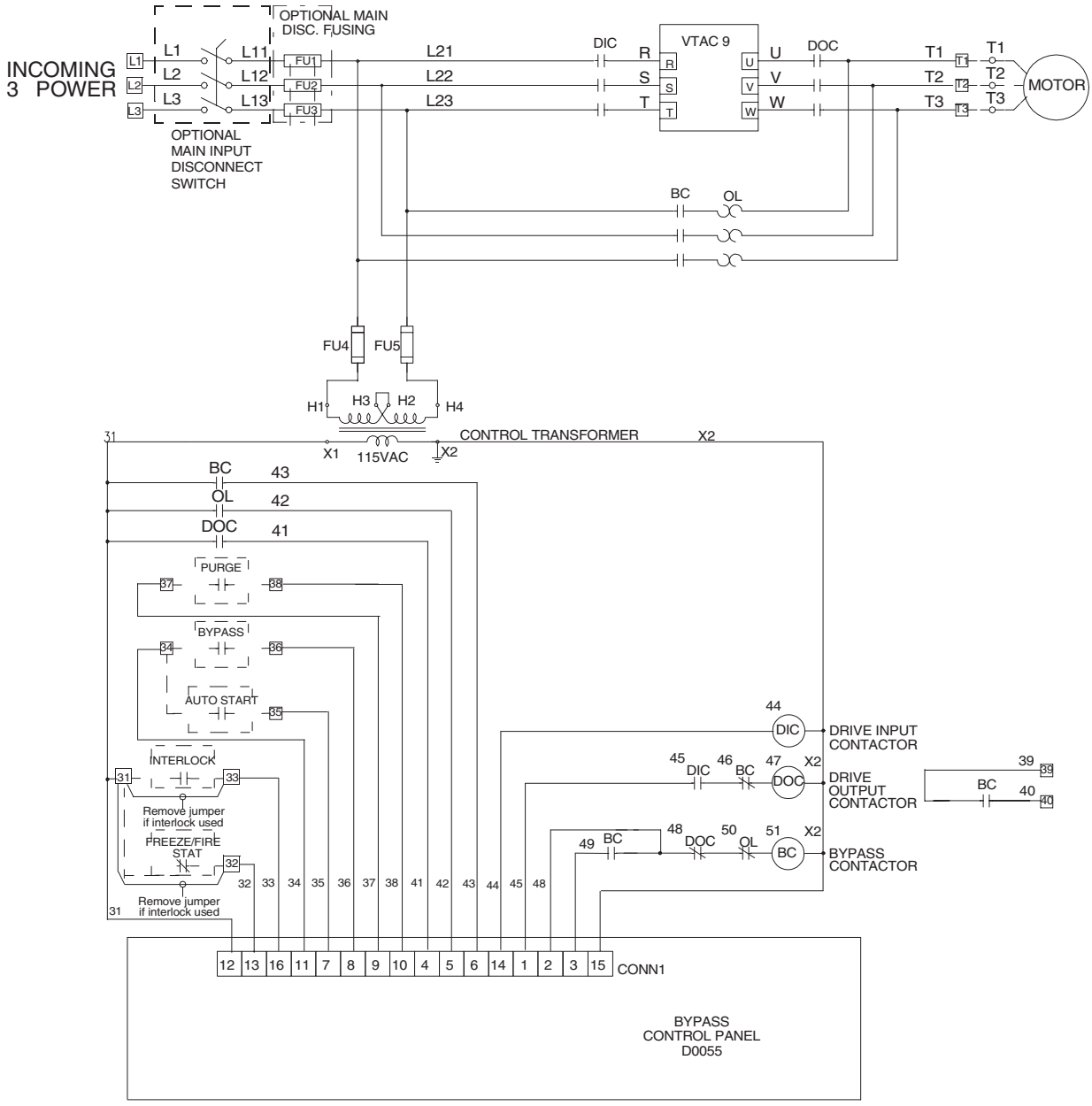
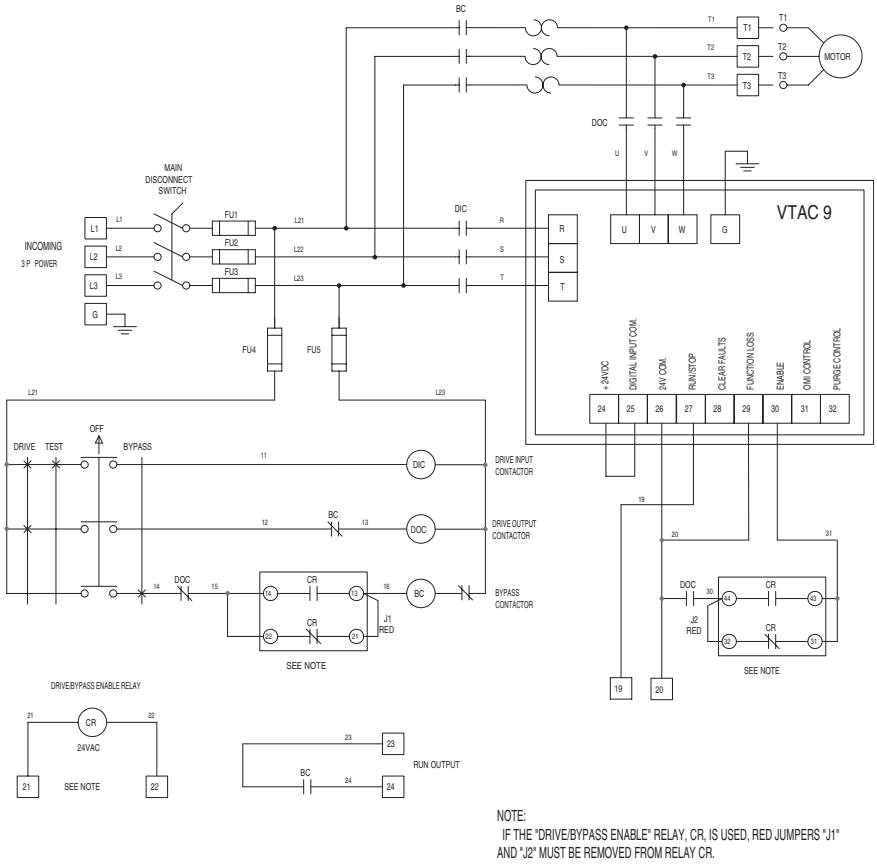


Figure 6.8 VTAC 9 Factory Wiring Schematic - Style M

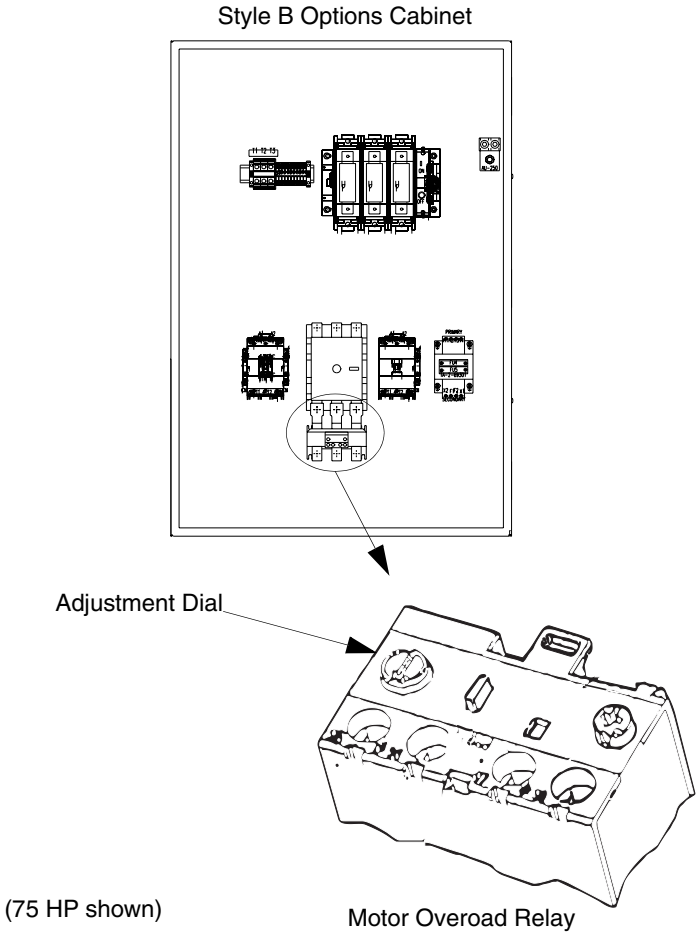


Verifying the Motor Overload Relay Setting

The motor overload relay is set at the factory to 100% of the drive output current. In many cases, this setting matches the motor full load amps (FLA). However, before starting the drive, you should check the setting on the motor overload relay to assure that it is set properly for your motor (see Figure 6.9).

- For motors with a service factor less than 1.15, set the motor overload relay to 0.9 x motor FLA.
- For motors with a service factor equal to, or greater than, 1.15, set the motor overload relay equal to the motor FLA.

Figure 6.9 Setting Motor Overload



Installing Control Wiring

This chapter describes how to wire the signal and I/O terminal block for stop, speed feedback, and remote control signals.

For drives without options, the terminal block is located on the Main Control board. For drives that have an options cabinet, a second terminal block is located in the options cabinet.

Wiring of the drive terminal block is detailed in Table 7.A and Table 7.C. Wiring of the options cabinet terminal block is detailed in Table 7.B.

Stop Circuit Requirements

ATTENTION: You must provide an external, hardwired emergency stop circuit outside of the drive circuitry. This circuit must disable the system in case of improper operation. Uncontrolled machine operation can result if this procedure is not followed. Failure to observe this precaution could result in bodily injury.

Depending upon the requirements of the application, the VTAC 9 drive can be configured to provide either a coast-to-rest or a ramp-to-rest operational stop without physical separation of the power source from the motor. A coast-to-rest stop turns off the transistor power device drivers. A ramp-to-rest stop fires the transistor power device drivers until the motor comes to a stop, and then turns off the power devices.

In addition to the operational stop, you must provide a hardwired emergency stop external to the drive. The emergency stop circuit must contain only hardwired electromechanical components. Operation of the emergency stop must not depend on electronic logic (hardware or software) or on the communication of commands over an electronic network or link.

Note that the hardwired emergency stop you install can be used at any time to stop the drive.

User-Initiated Stopping

ATTENTION: Note the following about stop commands:

- A stop command from any attached OIM will always be enabled regardless of the value of Logic Source Sel.
- Network stop commands are effective only when Logic Source Sel is set to Network or All Ports.
- Terminal block stop commands are effective only when Logic Source Sel is set to Terminal Blk or All Ports.

Failure to observe these precautions could result in severe bodily injury or loss of life.

The terminal block Drive Enable and Function Loss inputs are always active. The terminal block Stop input must be energized only when the terminal block is the control source.

Control and Signal Inputs

The drive has six logic inputs that are configurable using parameters 361 to 366. The logic inputs are 115V AC.

There are two relay outputs that are configurable using parameters 380 to 387, two analog inputs, and one analog output.

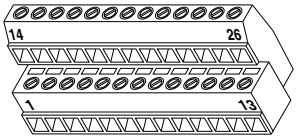
Wiring the Signal and Control I/O

Wire the drive's signal and control I/O to the terminal block as described in the following sections.

The following section describes how to wire signal and control I/O for 1 to 20 HP drives. The remaining sections describe how to wire signal and control I/O for 25 to 150 HP drives.

Wiring 1 to 20 HP Drives

Table 7.A Wiring the Signal and Control I/O Terminal Block - 1 to 20 HP



No.	Signal	Factory Default	Description	Related Param.
1	Digital In1	Run	11.2 mA @ 24V DC 19.2V minimum on state 3.2V maximum off state **Important:** Use only 24V DC, not suitable for 115V AC circuitry.	361 - 366
2	Digital In2	Clear Faults		
3	Digital In3	Function Loss		
4	Digital In4	Drive Enable		
5	Digital In5	OIM Control		
6	Digital In6	Purge		
7	24V Common	–	Drive-supplied power for Digital In1-6 inputs. 150mA maximum load.	
8	Digital In Common	–		
9	+24V DC	–		
10	+10V Pot Reference	–	2k ohm minimum load.	
11	Digital Out1 – N.O.	Fault	**Rated resistive load:** 250V AC, 220V DC Max. 0.4A @125VAC 0.8A @ 30VDC 10 µA, 10 mV DC Min. 50 VA, 60 W Max. **Rated inductive load:** 250V AC, 220V DC Max. 0.2A @125VAC 1.0A @ 30VDC 25 VA, 30 W Max.	380 - 387
12	Digital Out1 Common			
13	Digital Out1 – N.C.			
14	Analog Volts In1 (–)	Voltage reads value at 14, 15(1)	Non-isolated, 0 to +10V, 10 bit, 52k ohm input impedance.(2)	320 - 327
15	Analog Volts In1 (+)			
16	Analog Curr In1 (–)		Non-isolated, 4 to 20mA, 10 bit, 100 ohm input impedance.2	
17	Analog Curr In1 (+)			
18	Analog Volts In2 (–)	Voltage reads value at 18, 19[1]	Isolated, bipolar, differential, 0 to +10V unipolar (10 bit) or ±10V bipolar (9 bit & sign), 89k ohm input impedance.(3)	
19	Analog Volts In2 (+)			
20	Analog Curr In2 (–)		Isolated, 4 to 20mA, 9 bit & sign, 100 ohm input impedance.3	
21	Analog Curr In2 (+)			
22	Analog Volts Out (–) / Pot Common	Output Freq[1]	0 to +10V, 10 bit, 10k ohm (2k ohm minimum) load.	340 - 344
23	Analog Volts Out (+)			
24	Digital Out2 – N.O.	Run	See description at terminal numbers 11-13.	380 - 387
25	Digital Out2 Common			
26	Digital Out2 – N.C.			

(1) These inputs/outputs are dependent on a number of parameters. See Related Parameters.

(2) Differential Isolation - External source must be less than 10V with respect to PE.

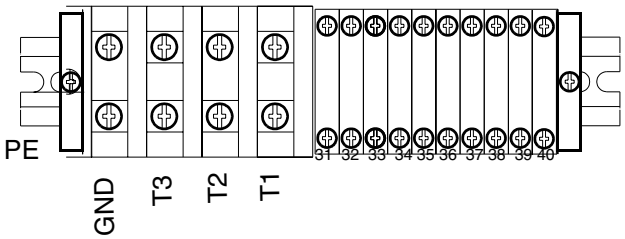
(3) Differential Isolation - External source must be maintained at less than 160V with respect to PE. Input provides high common mode immunity.

Important: For style B drives, terminals 1 through 7 are factory-wired to the I/O terminal block in the options cabinet (labeled terminals 31 to 40).

Wire the following signals at the options cabinet I/O terminal block (terminals 31 to 40):

- Interlocks
- Freeze/Fire Stats
- Autostart
- Bypass
- Purge
- Bypass Running

Table 7.B Wiring Signal and Control I/O to the Option Cabinet Terminal Block



No.	Function	Description	Related Param.
31	115V AC	115V AC circuitry.	361-366
32	Interlocks (Drive Enable)		
33	Freeze/Fire Stats		
34	115V AC		
35	Autostart		
36	Bypass		
37	Purge		
38			
39	Bypass Running		
40			

Removing the I/O Terminal Block

Important: The information in this section applies only to drives 25 HP and larger.

Step 1. Open the drive cover.

Step 2. Grip the I/O terminal at the top and botom, and pull straight out.

Step 3. After wiring the terminal block, align the pins and press the terminal block back into place.

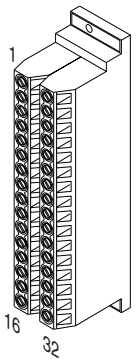
Wiring Drives 25 HP and Larger

Important: For style B drives, terminals 26 through 32 are factory-wired to the I/O terminal block in the options cabinet (labeled terminals 31 to 40). See Table 7.C.

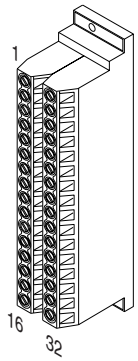
Wire the following signals at the options cabinet I/O terminal block (terminals 31 to 40):

- Interlocks
- Freeze/Fire Stats
- Autostart
- Bypass
- Purge
- Bypass Running

Table 7.C Wiring the Signal and Control I/O Terminal Block - 25 HP and Larger



No.	Signal	Factory Default	Description	Related Param.
1	Anlg Volts In 1 (–)	(1)	Isolated(2), bipolar, differential, ±10V, 11 bit & sign, 100k ohm input impedance.	320 - 329
2	Anlg Volts In 1 (+)			
3	Anlg Volts In 2 (–)	1	Isolated (3), bipolar, differential, ±10V, 11 bit & sign, 100k ohm input impedance.	
4	Anlg Volts In 2 (+)			
5	Pot Common	–	For (+) and (–) 10V pot references.	
6	Anlg Volts Out 1 (–)	Output Freq[1]	Bipolar, differential, ±10V, 11 bit & sign, 2k ohm minimum load.	338 - 346
7	Anlg Volts Out 1 (+)			
8	Anlg Current Out 1 (–)	1	4-20mA, 11 bit & sign, 400 ohm maximum load.	
9	Anlg Current Out 1 (+)			
10	Reserved			
11	Digital Out 1 – N.C.	Fault	Resistive Load Rating: 2A at 250V AC/30V DC Min. Load: 10mA Inductive Load Rating: 2A at 250V AC/30V DC Min. Load: 10mA	380 - 387
12	Digital Out 1 Common			
13	Digital Out 1 – N.O.			
14	Digital Out 2 – N.C.	Run		
15	Digital Out 2 Common			
16	Digital Out 2 – N.O.			
17	Anlg Current In 1 (–)	1	Isolated[2], 4-20mA, 11 bit & sign, 124 ohm input impedance.	320 -329
18	Anlg Current In 1 (+)			
19	Anlg Current In 2 (–)	1	Isolated[2], 4-20mA, 11 bit & sign, 124 ohm input impedance.	
20	Anlg Current In 2 (+)			
21	–10V Pot Reference	–	2k ohm minimum, 15mA maximum load.	
22	+10V Pot Reference	–		
23	Reserved			



No.	Signal	Factory Default	Description	Related Param.
24	+24V DC	–	Drive supplied power for logic inputs. 150mA maximum Load.	
25	Digital In Common	–		
26	24V Common	–	Drive supplied power for logic inputs. 150mA maximum Load.	
27	Digital In1	Run/Stop	11.2 mA @ 24V DC 19.2V minimum on state 3.2V maximum off state **Important:** Use only 24V DC; not suitable for 115V AC circuitry.	361 -366
28	Digital In2	Clear Faults		
29	Digital In3	Function Loss		
30	Digital In4	Drive Enable		
31	Digital In5	OIM Control		
32	Digital In6	Purge		

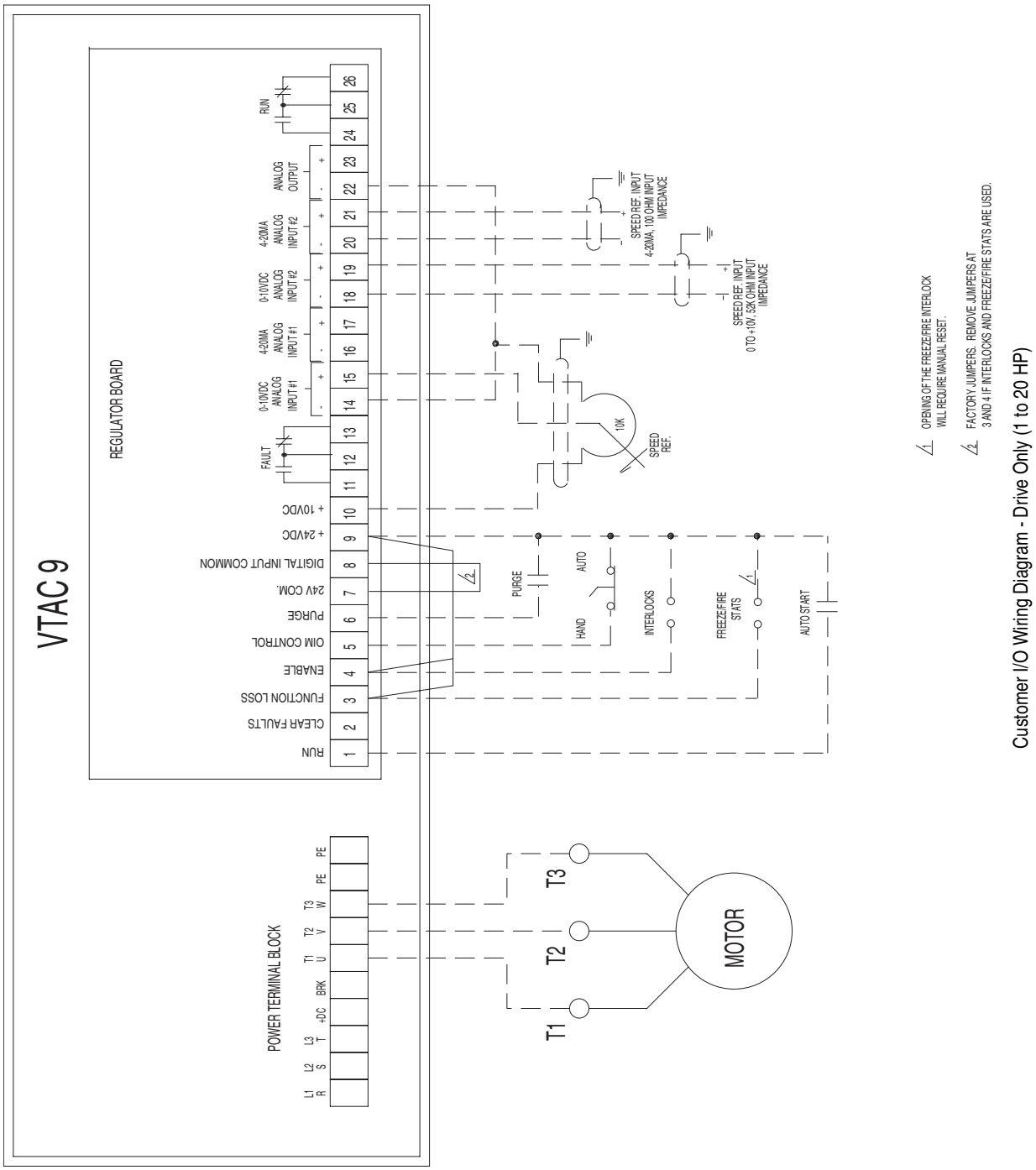
(1) These inputs/outputs are dependant on a number of parameters. See “Related Parameters.”

(2) Differential Isolation - External source must be maintained at less than 160V with respect to PE. Input provides high common mode immunity.

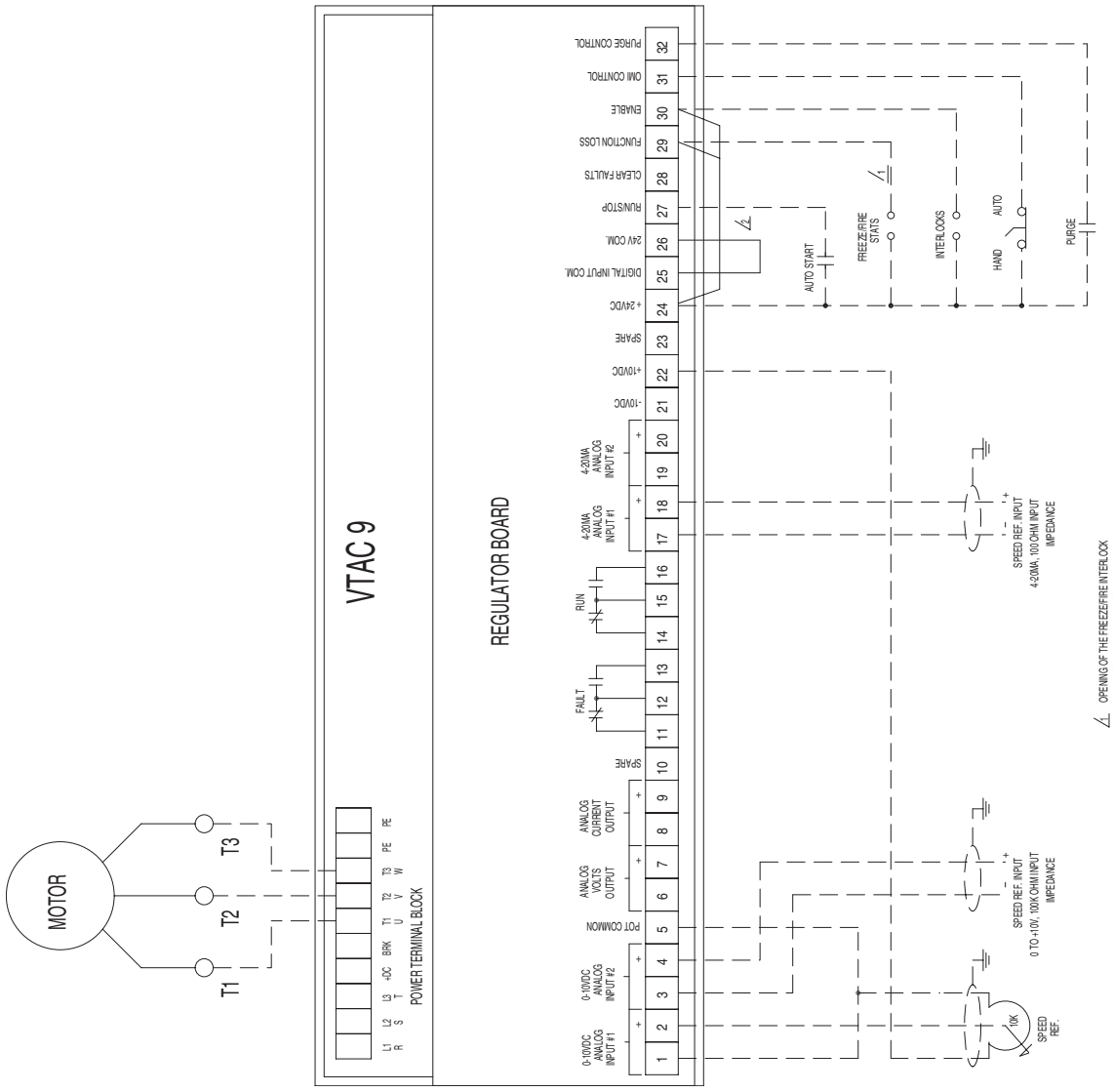
(3) Differential Isolation - External source must be less than 10V with respect to PE.

I/O Wiring Diagrams

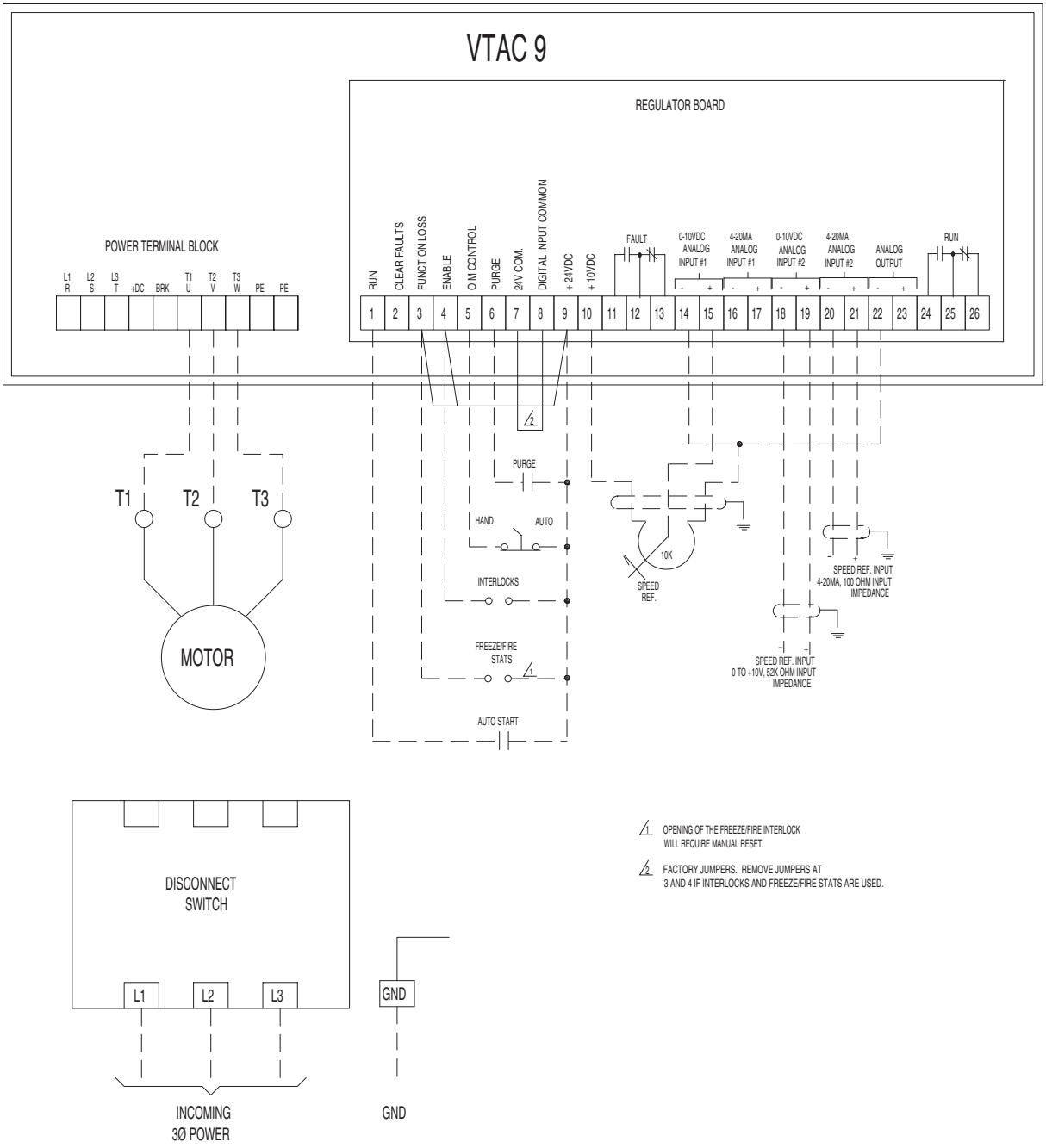
ATTENTION: When the terminal block is the control source, opening the Run contact (terminals 1, 9) will stop the drive. When a network or the OIM is the control source, opening any of the following will stop the drive: Function Loss (3,9), or Enable (4,9). Failure to observe this precaution could result in severe bodily injury or loss of life.



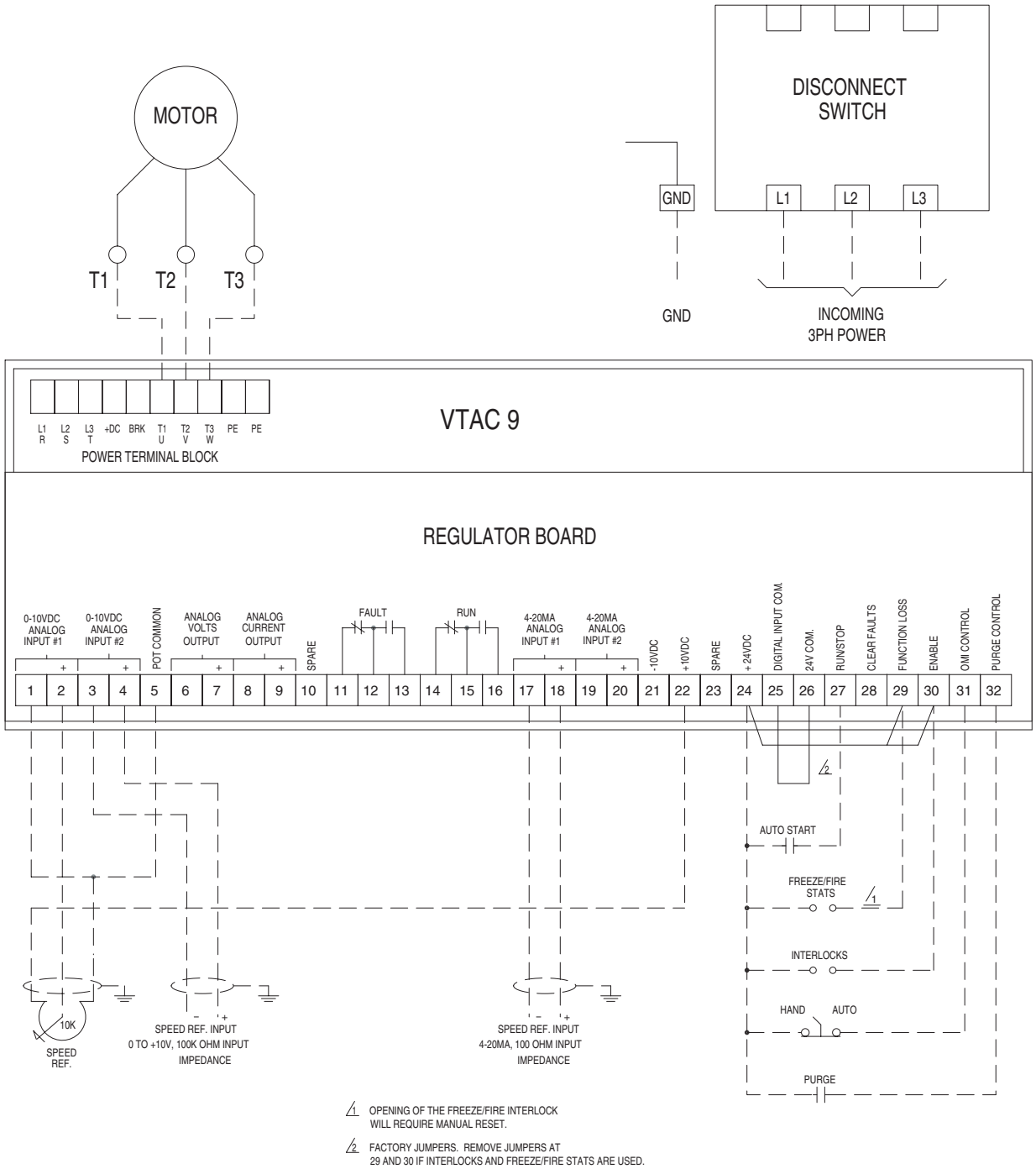
Customer I/O Wiring Diagram - Drive Only (1 to 20 HP)



Customer I/O Wiring Diagram - Drive Only - 25 or larger HP



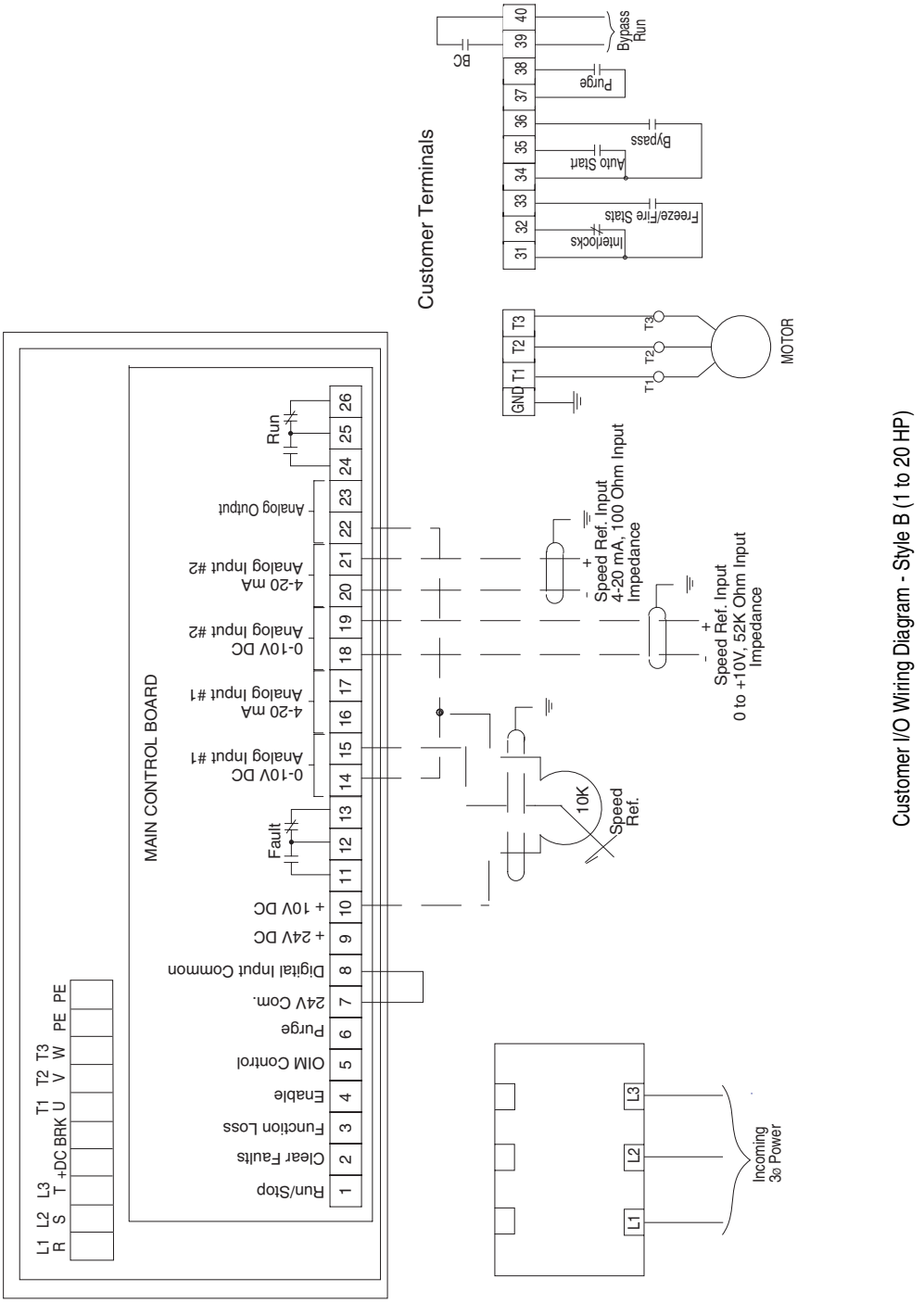
Customer I/O Wiring Diagram - Style A (1 to 20 HP)



Customer I/O Wiring Diagram - Style A (25 HP and Larger)

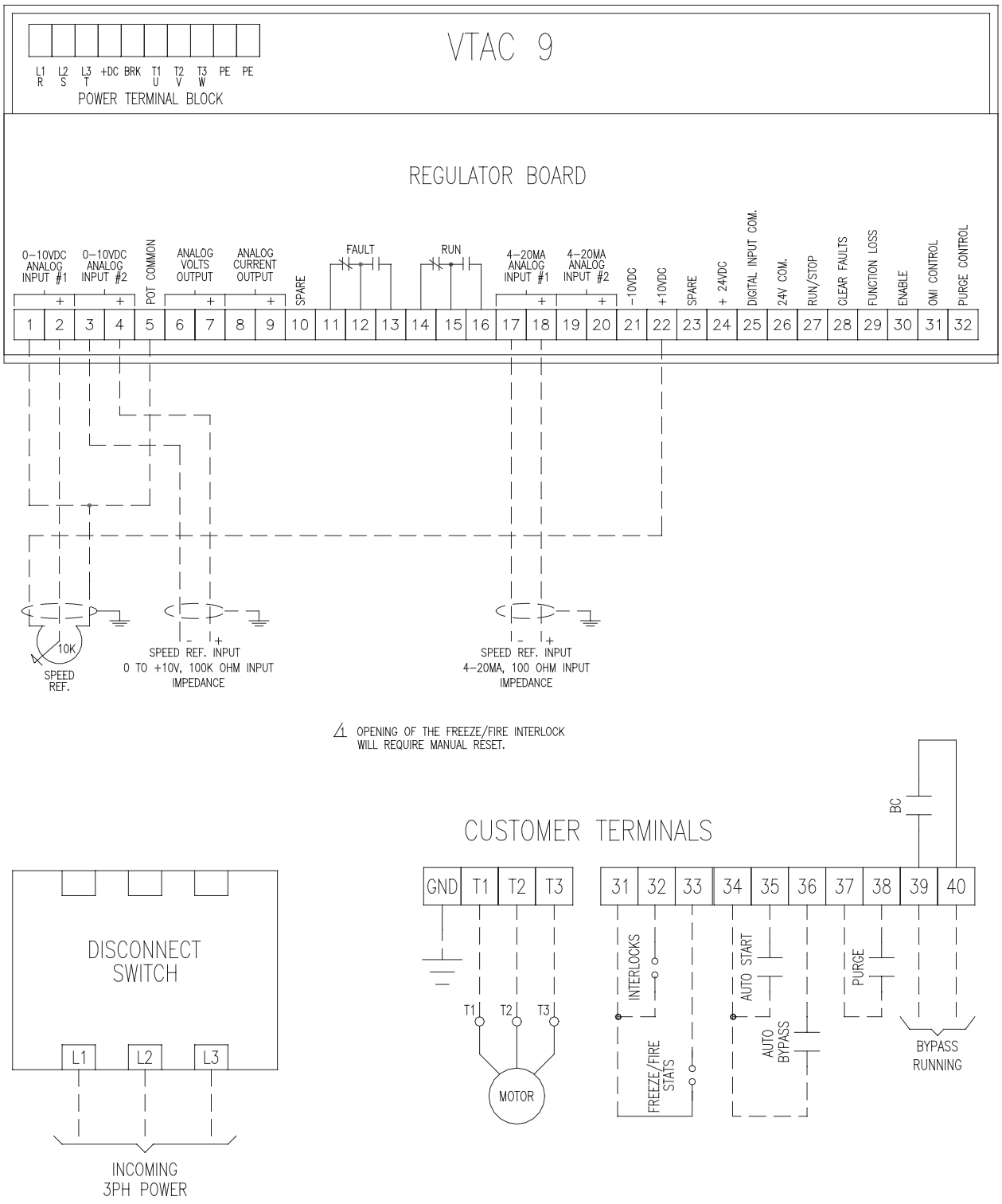
ATTENTION: When the terminal block is the control source, opening the AutoStart contact (terminals 34, 35) will stop the drive. When a network or the OIM is the control source, opening any of the following will stop the drive: Interlocks (31, 32), Freeze/Fire Stats (31, 33), or AutoStart (34,35). Failure to observe this precaution could result in severe bodily injury or loss of life.

Important: The drive is shipped with a default configuration of kepad control and OIM reference. To change these conditions, see parameters 89 and 90.

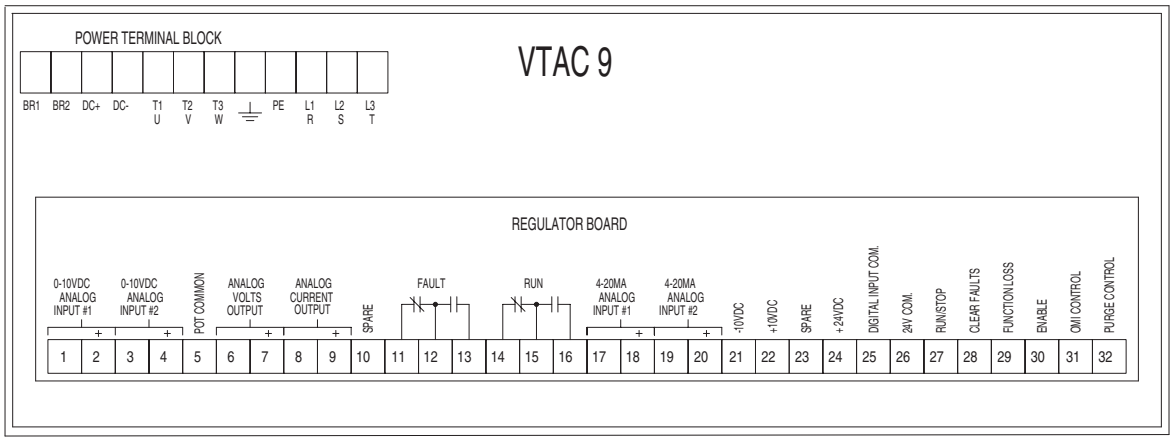


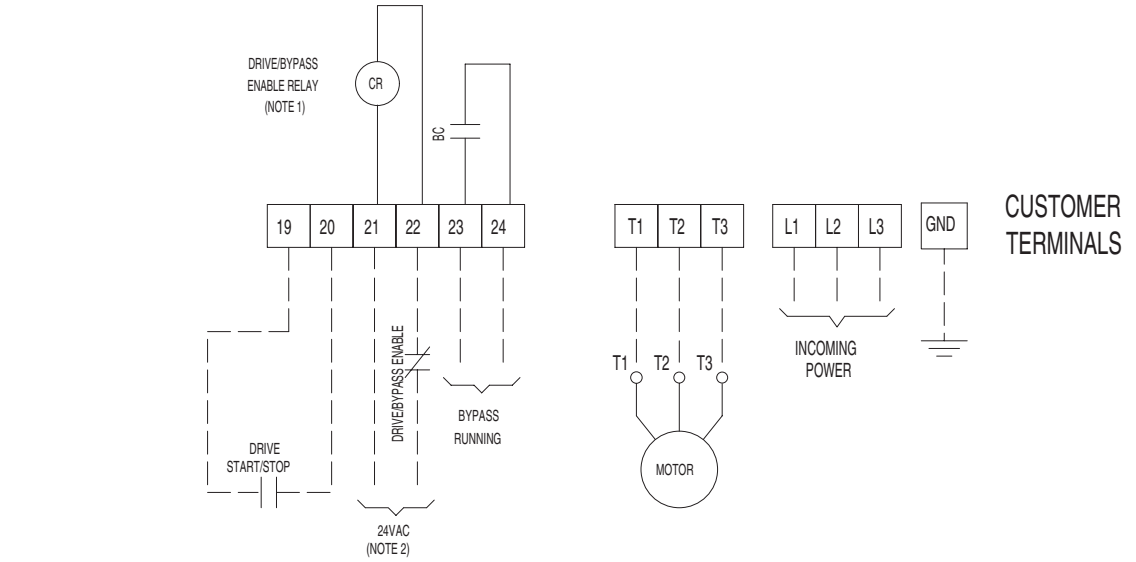
Customer I/O Wiring Diagram - Style B (1 to 20 HP)

Important: The drive is shipped with a default configuration of kepad control and OIM reference. To change these conditions, see parameters 89 and 90.



Customer I/O Wiring Diagram - Style B (25 HP and Larger)



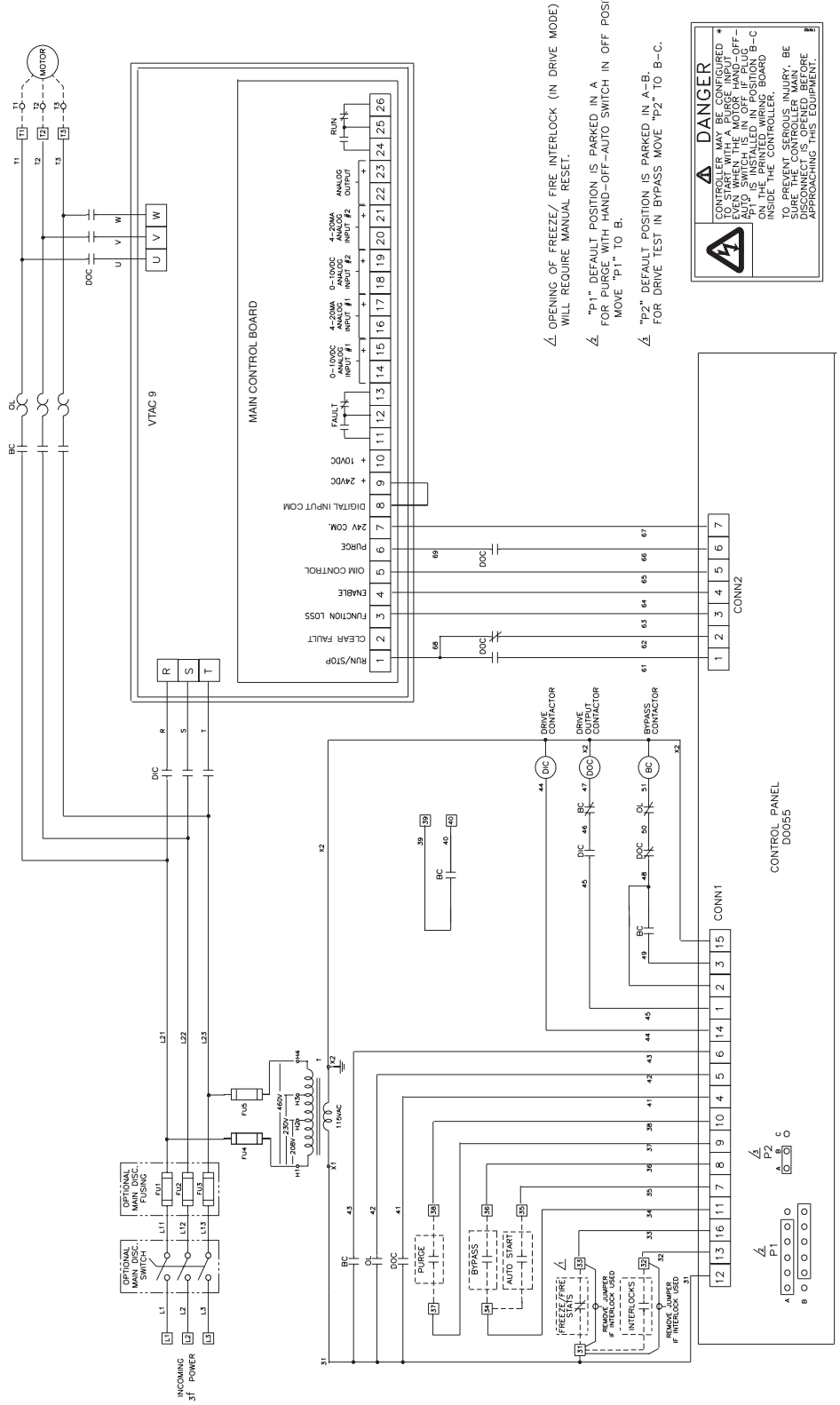


NOTE:

(1) IF THE "DRIVE/BYPASS ENABLE" RELAY, CR, IS USED, RED JUMPERS "J1" AND "J2" MUST BE REMOVED FROM RELAY CR.

(2) DRIVE/BYPASS ENABLE INPUT MAY ALSO BE USED FOR FREEZE/FIRE STATUS INPUTS.

Style M(1 to 20 HP)



4 OPENING OF FREEZE/ FIRE INTERLOCK (IN DRIVE MODE) WILL REQUIRE MANUAL RESET.

4 "P1" DEFAULT POSITION IS PARKED IN A FOR PURGE WITH HAND-OFF-AUTO SWITCH IN OFF POSITION MOVE "P1" TO B.

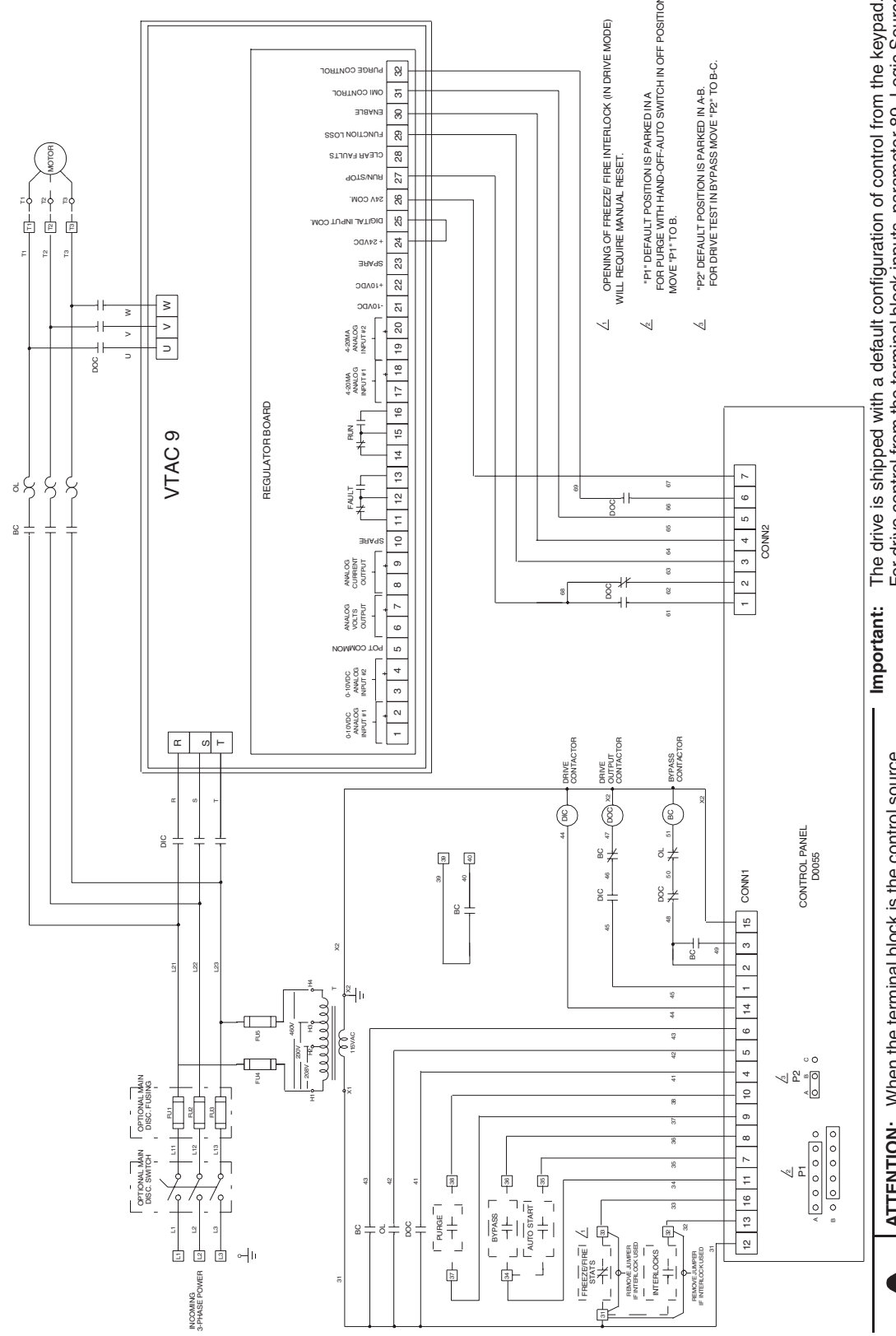
4 "P2" DEFAULT POSITION IS PARKED IN A-B. FOR DRIVE TEST IN BYPASS MOVE "P2" TO B-C.

ATTENTION: When the terminal block is the control source, opening the AutoStart contact (terminals 34, 35) will stop the drive. When a network or the OIM is the control source, opening any of the following will stop the drive: Interlocks (31, 32), Freeze/Fire Stats (31, 33), or AutoStart (34,35). Failure to observe this precaution could result in severe bodily injury or loss of life.

Important: The drive is shipped with a default configuration of control from the keypad. For drive control from the terminal block inputs, parameter 89, Logic Source Sel, must be set to 0.

Important: The terminal block Drive Enable and Function Loss inputs are always active. The terminal block Stop input must be closed to start the drive only when the terminal block is the control source.

VTAC 9 Factory Wiring Diagram- Style B (1 to 20 HP)

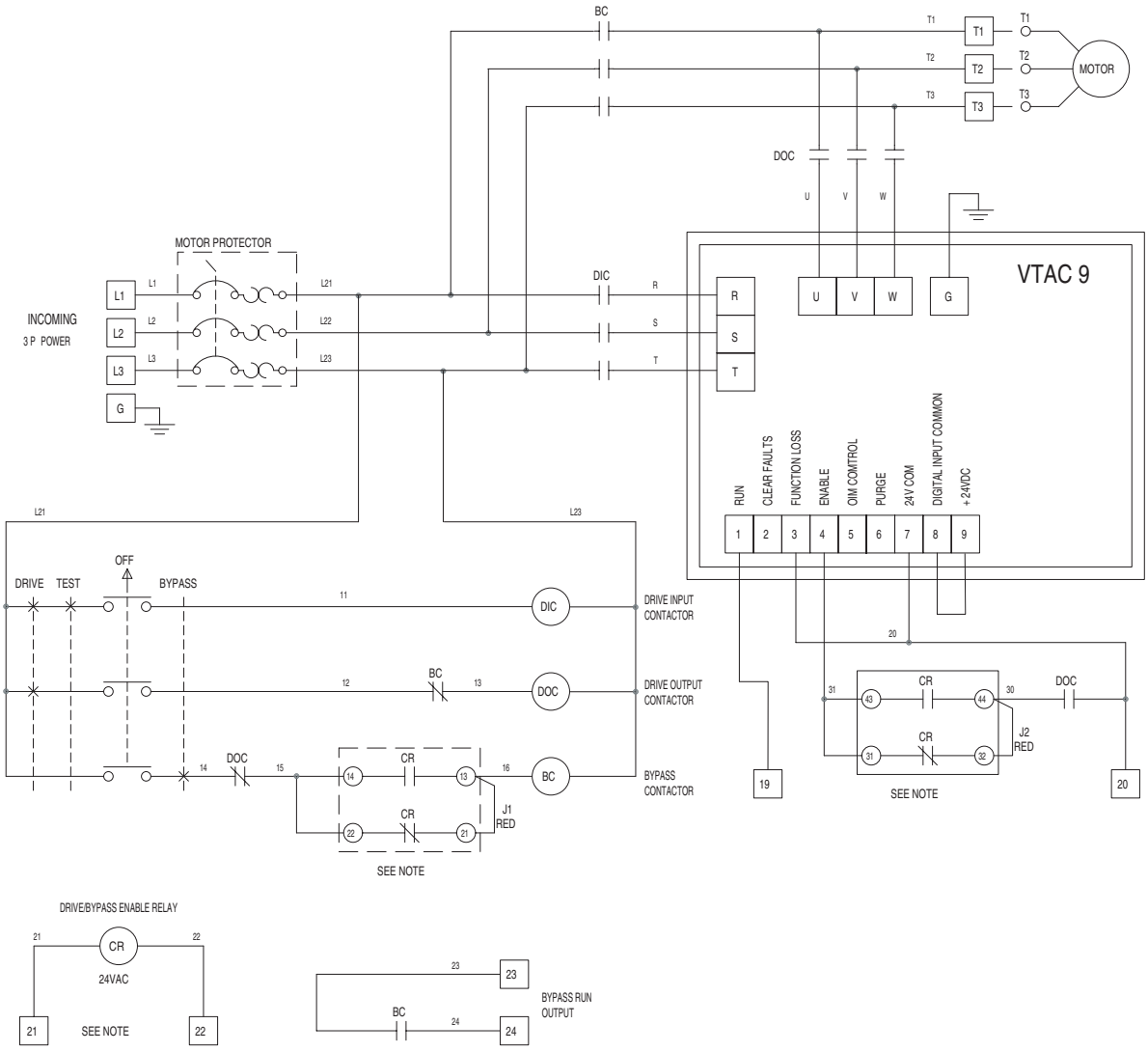

VTAC 9
REGULATOR BOARD
MOTOR
INCOMING 3-PHASE POWER
OPTIONAL MAIN DISC. SWITCH
OPTIONAL MAIN DISC. FUSING
CONTROL PANEL D0055
CONN1
CONN2
DRIVE CONTACTOR
DRIVE OUTPUT CONTACTOR
BYPASS CONTACTOR
PURGE
BYPASS
AUTO START
FREEZE/FIRE STAT
INTERLOCKS
REMOVE JUMPER IF INTERLOCK USED
OPENING OF FREEZE/ FIRE INTERLOCK (IN DRIVE MODE) WILL REQUIRE MANUAL RESET.
"P1" DEFAULT POSITION IS PARKED IN A FOR PURGE WITH HAND-OFF-AUTO SWITCH IN OFF POSITION MOVE "P1" TO B.
"P2" DEFAULT POSITION IS PARKED IN A-B. FOR DRIVE TEST IN BYPASS MOVE "P2" TO B-C.

Important: The drive is shipped with a default configuration of control from the keypad. For drive control from the terminal block inputs, parameter 89, Logic Source Sel, must be set to 0.

Important: The terminal block Drive Enable and Function Loss inputs are always active. The terminal block Stop input must be closed to start the drive only when the terminal block is the control source.

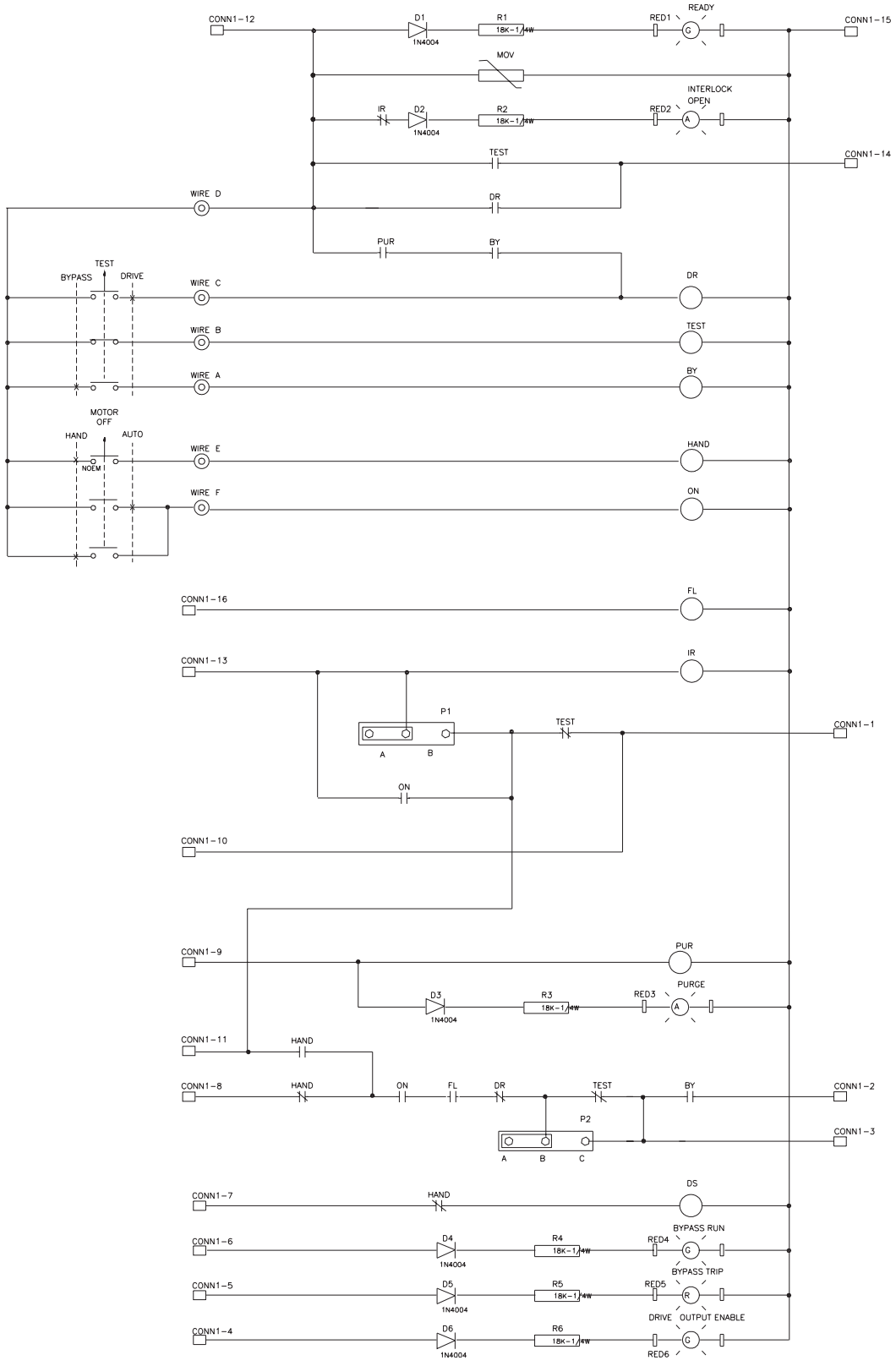
ATTENTION: When the terminal block is the control source, opening the AutoStart contact (terminals 34, 35) will stop the drive. When a network or the OIM is the control source, opening any of the following will stop the drive: Interlocks (31, 32), Freeze/ Fire Stats (31, 33), or AutoStart (34,35). Failure to observe this precaution could result in severe bodily injury or loss of life.

VTAC 9 Factory Wiring Diagram- Style B (25 HP and Larger)

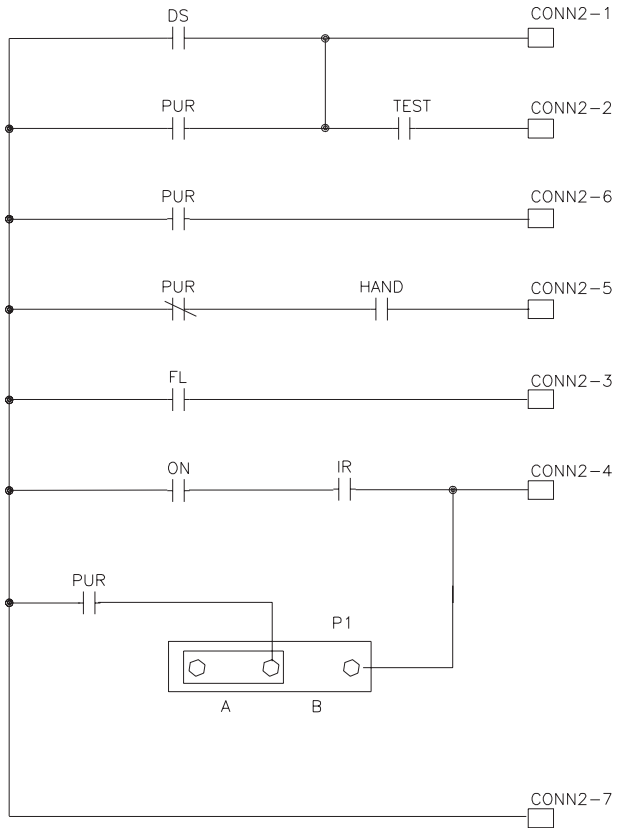


NOTE:
IF THE "DRIVE/BYPASS ENABLE" RELAY, CR, IS USED, RED JUMPERS "J1" AND "J2" MUST BE REMOVED FROM RELAY CR.

VTAC 9 Factory Wiring Diagram- Style M(1 to 20 HP)



Bypass Control Logic Board Wiring Diagram



Bypass Control Logic Board Wiring Diagram, cont'd

Bypass Operation Overview

A complete three-contactor bypass is provided in the VTAC 9 Style B option cabinet (see figure 7.11). This allows the motor to be safely transferred from drive output to the AC line, or from the AC line to the drive, while the motor is at zero speed. The contactor bypass is electrically interlocked.

The contactors function as follows:

1. Drive-input contactor (DIC) opens and closes input to the drive.
2. Drive-output contactor (DOC) opens and closes the connection between the drive and the motor.
3. Bypass contactor (BC) opens and closes the connection to line-start the motor.

The three-position Hand/Off/Auto switch and the Drive/Drive Test/Bypass switch on the bypass operator interface allows the user to obtain the operation described in Table 7.D.

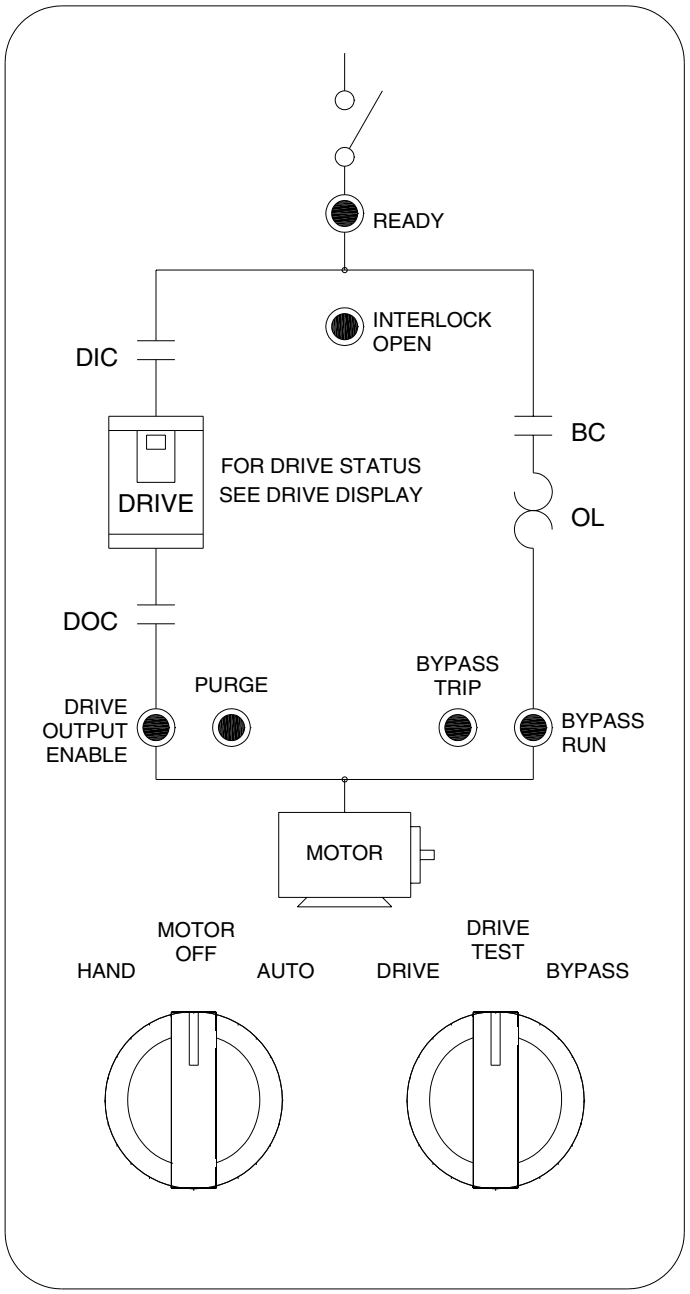
Table 7.D Bypass Switch Combinations

SWITCH SELECTION	HAND	OFF	AUTO
DRIVE	- Contactors DIC[1] and DOC[1] are energized. Contactor BC[1] is de-energized. - Start signal from local OIM[1]. - Speed Ref Select is automatically forced to local OIM at the transition to HAND. - The speed reference can be toggled by AUTO/ HAND key on the OIM.	- Contactor DIC is energized. Contactors DOC and BC are de-energized. - Drive stops. (There is power to the drive.)	- Contactors DIC and DOC are energized. Contactor BC is de-energized. - The start signal is controlled by the selected Logic Source. - The speed reference can be toggled by AUTO/HAND key on the OIM.
DRIVE TEST	- Contactor DIC is energized. Contactors DOC and BC are de-energized (BC can be energized based on user's choice). - Start signal from local OIM. - Ref Source Select is automatically forced to local OIM at the transition to HAND. - The speed reference can be toggled by AUTO/MAN if the key is not disabled.	- Contactor DIC is energized. Contactor DOC and BC are de-energized (BC can be energized based on user's choice). - Drive stops. (There is power to the drive.)	- Contactor DIC is energized. Contactor DOC and BC are de-energized (BC can be energized based on user's choice). - The Start signal is controlled by the selected Logic Source. - The speed reference can be toggled by AUTO/MAN if the key is not disabled.
BYPASS	- Contactor BC is energized. Contactors DIC and DOC are de-energized.	- Contactors DIC, DOC, and BC are de-energized.	- Contactors DIC and DOC are de-energized. - Motor control is from customer's 2-wire control to the bypass terminal block (contactor BC closes based on remote operation).
On a purge condition	DIC and DOC are energized. (In OFF mode, DOC may be energized based on user's jumper connection in the bypass box.) BC is de-energized. Drive starts and runs at Purge Speed. Overrides control from any other source. Drive ignores stop command from communication network but can stop on a stop command from other source (for example, OIM, or stop due to drive fault).		

The operator interface on the bypass option box shows the following indicator LEDs:

- Ready (green) - On when power is applied to the drive-bypass unit.
- Interlock open (amber) - On when the customer interlock or Function Loss is de-energized.
- Bypass run (green) - On when the bypass contactor (BC) is energized.
- Bypass trip (red) - On when a bypass fault condition exists (for example, bypass motor overload has tripped).
- Purge (amber) - On when the purge condition is active.
- Drive output enable (green) - On when the drive output contactor (DOC) is energized.

Bypass Control Interfacee



Manual Bypass Operation Overview

A complete fused three-contactor bypass is provided in the VTAC 9 Style M option cabinet. This option operates the same as the standard bypass described in the previous sectionwith the following differences.

- This option is provided to manually transfer the motor between the drive and AC line.
- Remote or automatic bypass operation is not provided with this option.

A single door-mounted 4-position selector switch determines the state of the three contactors as described in Table 7.E

Table 7.E Manual Bypass Switch Combinations

Switch Selection	Drive Input Contactor	Drive Output Contactor	Bypass Contactor with MOL
Drive	Energized	Energized	De-energized
Test	Energized	De-energized	De-energized
Off	De-energized	De-energized	De-energized
Bypass	De-energized	De-energized	Energized

Additionally, a user-powered (24V AC) "Drive/ByPass" enable relay is provided for remote shut down of the unit. This relay can be used to turn off the motor whether the selector switch is in Drive or Bypass position. It can also be used for any safety-input interlocks (freeze/fire stats, smoke purge). To utilize this function, factory-installed jumpers must be removed and Normally Closed contacts must be field-wired to the appropriate input terminals.

Speed Reference Control

The following sections describe methods of obtaining the drive speed reference.

Auto Reference Sources

The drive speed reference can be obtained from a number of different sources. The source is determined by drive programming and the condition of the Speed Select Digital Inputs or reference select bits of a drive command word.

The default source for a speed reference is the selection programmed in Speed Ref A Sel (90). If Speed Select digital inputs are defined on the terminal block, the drive could use other parameters as the speed reference source.

Hand Reference Sources

The hand reference source for the drive can be any OIM requesting manual control. Hand reference control wil override any Auto reference (including that selected by digital inputs).

Hand/Off/Auto (HOA) Control

Auto/Hand reference control is determined by the transition of the HOA (Hand/Off/Auto) switch located on the front of the Bypass cabinet, if supplied. Refer to table 7.4 for a description of the HOA switch.

Important: The position of the HOA switch does not solely provide the speed reference source. The speed reference can be changed from the local OIM regardless of the position of the HOA switch.

Completing the Installation

This chapter provides instructions on how to perform a final check of the installation before power is applied to the drive.

ATTENTION: Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should start and adjust it. Read and understand this manual in its entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.

Checking the Installation

ATTENTION: DC bus capacitors retain hazardous voltages after input power has been disconnected. After disconnecting input power, wait five minutes for the DC bus capacitors to discharge and then check the voltage with a voltmeter to ensure the DC bus capacitors are discharged before touching any internal components. Failure to observe this precaution could result in severe bodily injury or loss of life.

ATTENTION: You must provide an external, hardwired emergency stop circuit outside of the drive circuitry. This circuit must disable the system in case of improper operation. Uncontrolled machine operation can result if this procedure is not followed. Failure to observe this precaution could result in bodily injury.

To verify the condition of the installation:

- ❏ Step 1. Turn off, lock out, and tag the input power to the drive. Wait five minutes.
- ❏ Step 2. Verify that the DC bus voltage is zero. See Chapter 12.
- ❏ Step 3. If a function loss coast-stop pushbutton has been installed, verify that it has been wired correctly.
- ❏ Step 4. Remove any debris, such as metal shavings, from around the drive.
- ❏ Step 5. Check that there is adequate air flow clearance around the drive.
- ❏ Step 6. Verify that there is nothing mounted behind the drive.

Step 7. Verify that the wiring to the terminal block and the power terminals is correct.

- ❏ Step 8. Check that the wire size is within terminal specification and that the terminals are tightened properly.
- ❏ Step 9. Check that user-supplied branch circuit protection is installed and correctly rated.
- ❏ Step 10. Check that the incoming power is rated correctly.
- ❏ Step 11. Check the motor installation and length of motor leads.
- ❏ Step 12. Disconnect any power correction capacitors connected between the drive and the motor.

- ❑ Step 13. Check that the rating of the transformer (if used) matches the drive requirements and is connected properly.
- ❑ Step 14. Verify that a properly-sized ground wire is installed and a suitable earth ground is used. Check for and eliminate any grounds between the motor frame and the motor power leads. Verify that all ground leads are unbroken.
- ❑ Step 15. Uncouple the motor from any driven machinery.

Powering Up after Installation is Complete

To verify that the drive is installed correctly and is receiving the proper line voltage:

- ❑ Step 1. Turn the drive's input power disconnect to the On position.
- ❑ Step 2. Apply power to the drive.
- ❑ Step 3. Follow the start-up procedure in Chapter 9

Using the Start-Up Routines on the LCD OIM

ATTENTION: Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate, or service this equipment. Read and understand this chapter in its entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.

ATTENTION: Incorrect values for some of the parameters in the Start-Up routines can cause the drive to operate improperly. Verify that the values of these parameters are appropriate for your application. Failure to observe this precaution could result in bodily injury.

For standard applications, the Start-Up routines on the LCD OIM enable you to configure the most commonly used parameters through a series of steps. This helps you set up the drive as quickly as possible.

For advanced applications, you may need to adjust additional parameters in the parameter list using either the LCD OIM or PC software.

Preparing for Start-Up

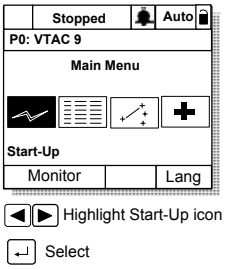
Before performing Start-Up, you must:

- be qualified to configure the drive and be familiar with the operation of AC drives.
- be familiar with the operation of the LCD OIM.
- have completed all hardware installation as described in chapters 3 through 8 of this manual.
- properly connect the drive to the motor.

Running the Start-Up Routines

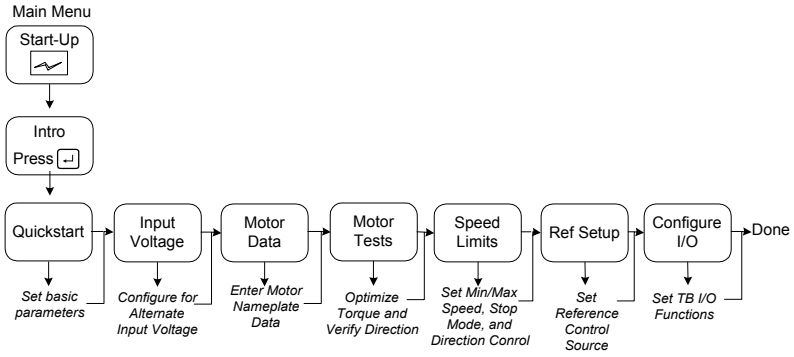
To access the Start-Up routines, select the Start-Up icon from the main menu as shown in figure Figure 9.1.

Figure 9.1 Accessing the Start-Up Routines



The Start-Up menu screen contains 8 selections. The first 7 menu items contain the most commonly used parameters associated with each function. See figure Figure 9.2.

Figure 9.2 Start-Up Menu



The Start-Up routine automates the process of entering values of selected parameters by taking you to the next parameter after you accept a parameter value. As each item in the list is completed, you are automatically advanced to the next step.

Important: Parameter values are saved as they are changed. Pressing ESC/PROG or aborting the Start-Up routine will not undo the changes.

You do not have to configure all of the parameters in all 7 menus. The first menu selection, Quickstart, contains the minimum basic parameters that must be configured before running the drive. These are listed in table Table 9.A.

Table 9.A Quickstart Parameters

Parameter No.	Parameter Name
155	Stop Mode A
42	Motor NP FLA
81	Minimum Speed
82	Maximum Speed
140	Accel Time 1
142	Decel Time 1
90	Speed Ref A Sel
362	Digital In2 Sel

If your application requires adjustment to parameters beyond those listed in table Table 9.A, you can adjust the parameters in any or all of the next 6 selections in the Start-Up menu, or you can adjust parameters individually through the Parameters menu.

As you adjust the parameters in the Start-Up routines, record them in Appendix E or F.

When you have completed adjusting all of the parameters in the Start-Up routines that your application requires, select the last item in the menu, Done.

Important: The drive is shiped with a default configuration of control from the keypad. For drive control from the terminal block inputs, parameter 89, Logic Source Sel, must be set to 0.

Exiting Before Completing the Start-Up Routines

To exit the Start-Up routines, press the F4 key (Exit). When you select the Start-Up icon from the main menu again, you will be prompted to either continue or restart the Start-Up routines. If you select “continue,” you will be returned to the point at which you exited.

Programming Basics

To program the drive for a specific application, you adjust the appropriate parameters. The parameters are used to define characteristics of the drive.

This chapter provides an overview of parameter types and how they are organized. Parameter descriptions are provided in Chapter 11.

About Parameters

There are three types of parameters:

- **Numbered List Parameters**
  Numbered list parameters allow a selection from two or more options. The LCD OIM displays a text message for each item.

  Example: Speed Ref A Sel (90)

- **Bit Parameters**
  Bit parameters have individual bits associated with features or conditions. If the bit is 0, the feature is off or the condition is false. If the bit is 1, the feature is on or the condition is true.

  Example: Drive Status 1 (209)

- Numeric Parameters
  These parameters have a single numerical value (for example, 0.1 volts).

  Example: Maximum Freq (55)

  Parameters are also either configurable or tunable, or read-only.

Configurable parameters can be adjusted or changed only while the drive is stopped.

Tunable parameters can be adjusted or changed while the drive is running or stopped.

Read-only parameters cannot be adjusted.

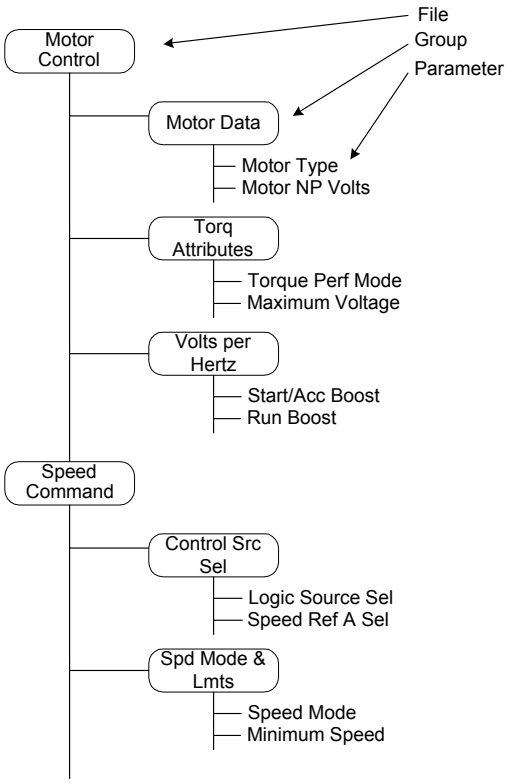
How Parameters are Organized

Parameters are organized into seven files:

- Monitor
- Motor Control
- Speed Command
- Dynamic Control
- Utility
- Communication
- Inputs & Outputs

Each file contains parameters that are grouped by their function. A file can contain several groups of parameters. See Figure 10.1.

Figure 10.1 Example of Parameter Organization



Accessing the Parameters

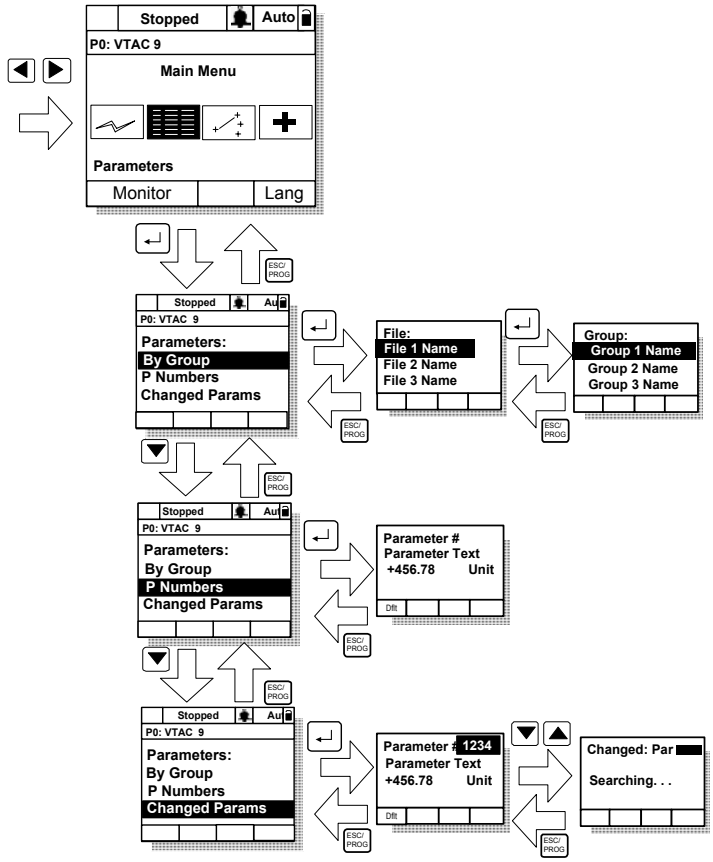
Parameters are programmed and viewed using the LCD OIM or VS Utilities software.

The LCD OIM displays parameters by group, by individual parameter number, and parameters that have changed from their default value.

To access parameters using the LCD OIM, select the Parameters icon from the main screen. See Figure 10.2.

See Appendix B for information on modifying parameters using the LCD OIM.

Figure 10.2 Accessing the Parameters Using the LCD OIM



Selecting the Parameter Access Level

The VTAC 9 drive provides two levels of access to the parameters: Standard (1) and Advanced (2).

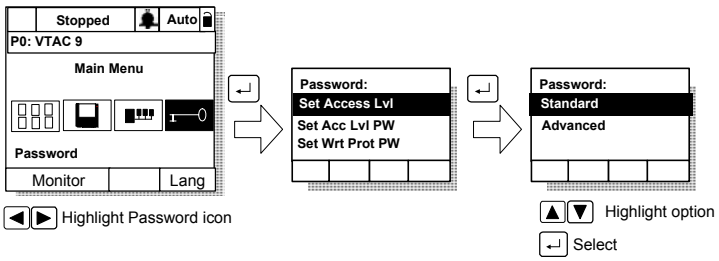
The Advanced level allows access to all of the parameters and is used for more sophisticated applications.

The Standard level allows access to a subset of the Advanced level and contains only the most commonly used parameters. See Appendix C for a list of the parameters available at the Standard level.

The active access level is displayed in Parameter Access Level (196).

To select the parameter access level using the LCD OIM, select the Password icon from the main menu. See Figure 10.3.

Figure 10.3 Selecting the Parameter Access Level



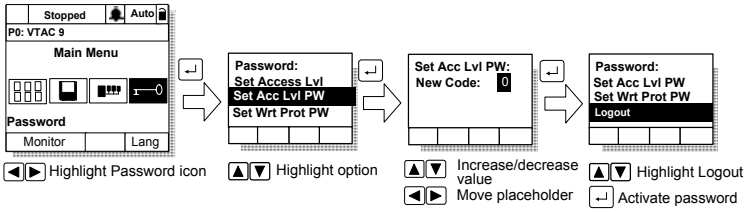
Restricting Access to the Advanced Parameter Level

ATTENTION: It is the user's responsibility to determine how to distribute the access level password. Rockwell Automation is not responsible for unauthorized access violations within the user's organization. Failure to observe this precaution could result in bodily injury.

The LCD OIM provides the option to restrict access to the Advanced parameter level. This feature requires the use of a user-defined password when an attempt to change the access level is made.

To set the access level password, select the Password icon from the main menu. See Figure 10.4. The password value can range from 1 to 9999. A value of 0 disables the password (factory default). You must either select Logout or return to the process display screen to activate the password.

Figure 10.4 Setting the Access Level Password



When you enter the password, you can change access levels until you select Logout or return to the process display screen, which re-activates the password. Refer to section B.8 in Appendix B for information about the process display screen.

Note that once the password is enabled, you will also be prompted to enter the password to access the Set Acc Lvl PW option.

If There is More Than One OIM Connected to the Drive

Note that setting or changing the access level password on one OIM will set or change the access level password for all OIMs connected to the drive.

Ensuring Program Security

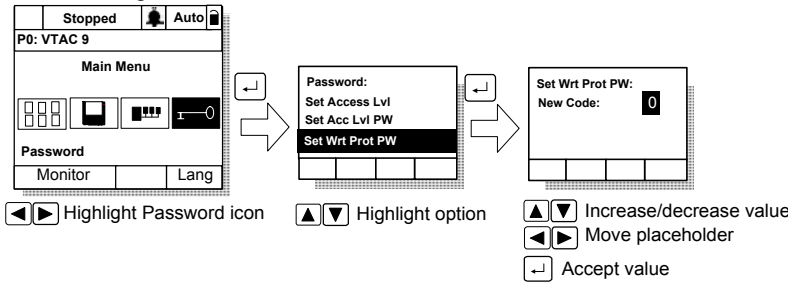
ATTENTION: It is the user's responsibility to determine how to distribute the write-protect password. Rockwell Automation is not responsible for unauthorized access violations within the user's organization. Failure to observe this precaution could result in bodily injury.

Parameter values can be password-protected using the LCD OIM. When the password is enabled, parameter values can be displayed. However, if there is an attempt to change a parameter value, a password pop-up box will appear on the OIM screen to prompt for the user-defined password.

To set the write-protect password, select the Password icon from the main menu. See Figure 10.5. The password value can range from 1 to 9999. A value of 0 disables the password (factory default).

When the password is enabled, the lock symbol on the screen changes from 🔓 to 🔒.

Figure 10.5 Setting the Write-Protect Password



When you enter the password, you can adjust parameters until you select Logout or return to the process display screen, which re-activates the password. Refer to Appendix B for information about the process display screen.

If There is More Than One OIM Connected to the Drive

Important: Setting the write-protect password value to zero on one OIM will disable the write-protect password on all connected OIMs.

Setting the write-protect password in one OIM will not affect any other OIM connected to the drive unless a write-protect password has also been set in the other OIMs. In this case, the last password value entered becomes the password value for all password-protected OIMs. (Each OIM cannot have a different password value.)

For example, if the write-protect password has been set to 5555 for the local OIM, someone using a remote OIM with no write-protect password set can still program all of the parameters. If the write-protect password is then set to 6666 on the remote OIM, you will be required to enter 6666 on the local OIM to program the parameters.

Parameter Descriptions

The following information is provided for each parameter along with its description:

Parameter Number:	Unique number assigned to each parameter.
Parameter Name:	Unique name assigned to each parameter.
Range:	Predefined parameter limits or selections. Note that a negative Hz value indicates reverse rotation.
Default:	Factory default setting.
Access:	Parameter access level. 1 = Standard (reduced parameter set) 2 = Advanced (full parameter set)
Path:	Menu selections to reach specified parameter. The path is indicated in this manner: File>Group
See also:	Associated parameters that may provide additional or related information.

What the Symbols Mean

Symbol	Meaning
	32-bit parameter
	Drive must be stopped before changing parameter value.
	Used only with drives 25 HP and higher.

The parameters are presented in numerical order. AppendixTable D on page 1 contains a list of parameters by name cross-referenced to parameter number.

1 Output Freq

Range:	+/-400.0 Hz [0.1 Hz]
Default:	Read Only
Access:	1 **Path:** Monitor>Metering
See also:	

The output frequency present at T1, T2, and T3 (U, V, and W). This value includes reference, slip comp, and IR compensation.

2 Commanded Freq

Range:	+/- 400.0 Hz [0.1 Hz]
Default:	Read Only
Access:	0 **Path**: Monitor>Metering
See also:	

The value of the active pre-ramp reference frequency command.

3	**Output Current**
	Range: 0.0 to Drive Rated Amps x 2 [0.1 Amps]
	Default: Read Only
	Access: 0 **Path**: Monitor>Metering
	See also:

The total output current present at T1, T2, and T3 (U, V, and W), which includes torque and flux components.

4	**Torque Current**
	Range: Drive Rating x -2 to +2 [0.1 Amps]
	Default: Read Only
	Access: 1 **Path**: Monitor>Metering
	See also:

The amount of current that is in phase with the fundamental voltage component. This is the torque-producing component of the output current.

5	**Flux Current**
	Range: Drive Rating x -2 to +2 [0.1 Amps]
	Default: Read Only
	Access: 2 Path: Monitor>Metering
	See also:

The amount of current that is out of phase with the fundamental voltage component. This is the magnetizing component of the output current.

6	**Output Voltage**
	Range: 0.0 to Drive Rated Volts [0.1V AC]
	Default: Read Only
	Access: 1 **Path**: Monitor>Metering
	See also:

The output voltage present at terminals T1, T2, and T3 (U, V, and W).

7	**Output Power**
	Range: 0.0 to Drive Rated kW x 2 [0.1 kW]
	Default: Read Only
	Access: 1 **Path**: Monitor>Metering
	See also:

The output power present at T1, T2, and T3 (U, V, and W).

8	**Output Powr Fctr**
	Range: 0.00 to 1.00 [0.01]
	Default: Read Only
	Access: 2 **Path**: Monitor>Metering
	See also:

The output power factor.

9 Elapsed MWh

Range: 0.0 to 429,496,729.5 MWh [0.1 MWh]
Default: Read Only
Access: 1 **Path**: Monitor>Metering
See also:

The accumulated output energy of the drive.

10 Elapsed Run Time

Range: 0.0 to 429,496,729.5 Hr [0.1 Hr]
Default: Read Only
Access: 1 **Path**: Monitor>Metering
See also:

The accumulated time the drive has been outputting power.

11 MOP Frequency

Range: +/- 400.0 [0.1 Hz]
Default: Read Only
Access: 1 **Path**: Monitor>Metering
See also:

The setpoint value of the MOP (Motor-Operated Potentiometer) function.

12 DC Bus Voltage

Range: 0.0 to 460 / 920 VDC(1) [0.1 VDC]
Default: Read Only
Access: 1 **Path**: Monitor>Metering
See also:

(1) 200% of bus voltage limit.

The present DC bus voltage level.

13 DC Bus Memory

Range: 0.0 to 460 / 920 VDC(1) [0.1 VDC]
Default: Read Only
Access: 2 **Path**: Monitor>Metering
See also:

(1) 200% of bus voltage limit.

A six-minute average of the DC bus voltage level.

16 Analog In1 Value
17 Analog In2 Value

Range: 4.000 to 20.000 mA [0.001 mA]
-/+10.0 V [0.1 V]
Default: Read Only
Access: 16=1 **Path**: Monitor>Metering
17=2
See also: 320

The value of the signal at the analog inputs. This value does not include scaling information programmed by the user (for example, Analog In1 Hi). The terminals monitored depend on the setting of Anlg In Config (320). The inputs can be configured as voltage or current

26 **Rated kW**

Range: 0.37 to 87.0 kW [0.1 kW]
Default: Read Only
Access: 1 **Path**: Monitor>Drive Data
See also:

The drive power rating.

27 **Rated Volts**

Range: 208 to 600 V [0.1V AC]
Default: Read Only
Access: 1 **Path**: Monitor>Drive Data
See also:

The drive input voltage class (208, 240, 400, etc.).

28 **Rated Amps**

Range: 1.1 to 125.0 Amps [0.1 Amps]
Default: Read Only
Access: 1 **Path**: Monitor>Drive Data
See also:

The drive rated output current.

29 **Control SW Ver**

Range: 0.000 to 65.256 [0.001]
Default: Read Only
Access: 1 **Path**: Monitor>Drive Data
See also: 196

The Main Control board software version.

40 **Motor Type**

Range: 0 = Induction
1 = Synchr Reluc
2 = Synchr PM
Default: 0 = Induction
Access: 2 **Path**: Motor Control>Motor Data
See also:

Set to match the type of motor connected.

41 **Motor NP Volts**

Range: 0.0 to Drive Rated Volts [0.1V AC]
Default: Based on Drive Type
Access: 1 **Path**: Motor Control>Motor Data
See also:

Set to the motor nameplate rated volts. The motor nameplate base voltage defines the output voltage when operating at rated current, rated speed, and rated temperature.

42 **Motor NP FLA**

Range:	0.0 to Rated Amps x 2 [0.1 Amps]
Default:	Based on Drive Type
Access:	1 **Path**: Motor Control>Motor Data
See also:	47, 48

Set to the motor nameplate rated full load amps. The motor nameplate FLA defines the output amps when operating at rated voltage, rated speed, and rated temperature. It is used in the motor thermal overload and in the calculation of slip.

Set to the motor nameplate rated frequency. The motor nameplate base frequency defines the output frequency when operating at rated voltage, rated current, rated speed, and rated temperature.

Since the motor thermal overload cannot distinguish individual currents in a multimotor application, it is suggested that it be disabled in these cases. This can be done by setting the correct bit in Fault Config (238) to zero to disable the motor thermal overload.

The operation of the overload is actually based on three parameters: 1) Motor NP FLA (42), 2) Motor OL Factor (48), and 3) Motor OL Hertz (47). The motor nameplate full load amps is then multiplied by the motor overload factor to allow you to re-define the continuous level of current allowed by the motor thermal overload.

Motor Overload Hz is used to allow you to adjust the response of the motor thermal overload to lower motor speeds (lower output frequencies) where a higher degree of protection may be required due to decreased motor cooling.

43 **Motor NP Hertz**

Range:	5.0 to 400.0 Hz [0.1 Hz]
Default:	Based on Drive Type
Access:	1 **Path**: Motor Control>Motor Data
See also:	

Set to the motor nameplate rated frequency. The motor nameplate base frequency defines the output frequency when operating at rated voltage, rated current, rated speed, and rated temperature.

44 **Motor NP RPM**

Range:	60 to 24000 RPM [1 RPM]
Default:	1750 RPM
Access:	1 **Path**: Motor Control>Motor Data
See also:	

Set to the motor nameplate rated RPM. The motor nameplate RPM defines the rated speed when operating at motor nameplate base frequency, rated current, base voltage, and rated temperature. This is used to calculate slip.

45 Motor NP Power

Range: 0.00 to 1000.0 [0.01] (drives < 25 HP)
0.00 to 5000.00 [0.01] (drives > 25 HP)

Default: Based on Drive Type

Access: 1 **Path**: Motor Control>Motor Data

See also: 46

Set to the motor nameplate rated power. The motor nameplate power is used with the other nameplate values to calculate default values for motor parameters to assist the commissioning process. This may be entered in horsepower or in kilowatts as selected in parameter 46.

46 Mtr NP Pwr Units

Range: 0 = Horsepower
1 = kiloWatts

Default: Based on Drive Type

Access: 1 **Path**: Motor Control>Motor Data

See also:

Set to the power units shown on the motor nameplate. This parameter determines the units for parameter 45.

47 Motor OL Hertz

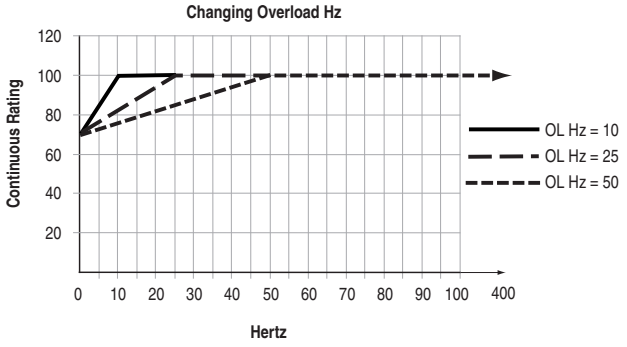
Range: 0.0 to 400.0 Hz [0.1 Hz]

Default: Motor NP Hz / 3

Access: 2 **Path**: Motor Control>Motor Data

See also: 42, 220

Selects the output frequency below which the motor operating current is derated. The motor thermal overload will generate a fault at lower levels of current. For all settings of overload Hz other than zero, the overload capacity is reduced to 70% when output frequency is zero.



48 Motor OL Factor

Range: 0.20 to 2.00 [0.01]

Default: 1.00

Access: 2 **Path**: Motor Control>Motor Data

See also: 42, 220

Sets the continuous current operating level for the motor.

This parameter can be used to raise the level of current that will cause the motor thermal overload to trip. The effective overload factor is a combination of parameters 47 and 48.

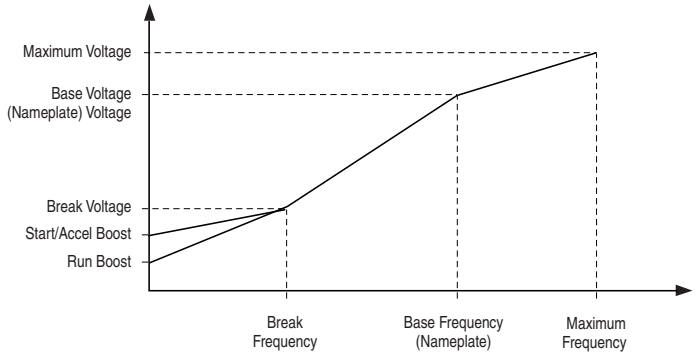
Motor FLA x OL Factor = Operating Level

53	**Torque Perf Mode**	
	Range:	0 = Sensrls Vect 1 = SV Economize 2 = Custom V/Hz 3 = Fan/Pmp-V/Hz
	Default:	3 = Fan/Pmp-V/Hz
	Access:	2 **Path**: Motor Control>Torq Attributes
	See also:	62, 63, 69, 70

Sets the method of motor torque production.

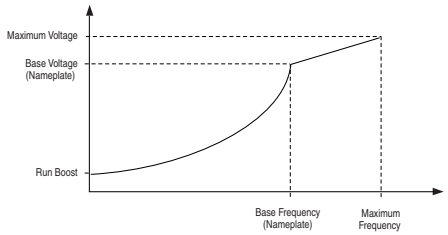
- Sensrls Vect maintains consistent magnetizing current up to base speed, and voltage increases as a function of load.
- SV Economize allows the drive to automatically adjust output voltage as the load changes to minimize current suplied to the motor. The voltage is adjusted by means of flux current adaption.
- Custom V/Hz allows for tailoring the volts/hertz curve by adjusting parameters 54, 55, 70, 71, and 72.

Figure 11.1 Custom V/Hz Curve



- Fan/Pmp V/Hz mode sets a fan load volts per hertz curve profile exponential to base frequency and linear from base to maximum frequency). Run boost can offset the low speed curve point.

Figure 11.2 Fan/Pump Curve



54 Maximum Voltage

Range:	(Rated Volts x 0.25) to Rated Volts [0.1V AC]
Default:	Drive Rated Volts
Access:	1 **Path**: Motor Control>Torq Attributes
See also:	

Sets the highest voltage the drive will output.

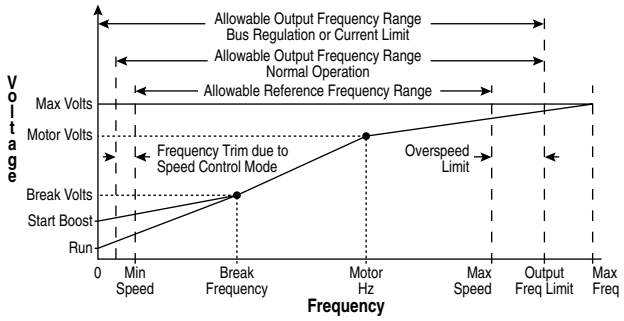
55 Maximum Freq

Range:	5.0 to 400.0 Hz [0.1 Hz]
Default:	130.0 Hz
Access:	1 **Path**: Motor Control>Torq Attributes
See also:	82, 83

Sets the maximum allowable frequency the drive will output. Note that is is not maximum speed, which is set in parameter 82.

Maximum Speed + Overspeed Limit must be ≤to Maximum Freq.

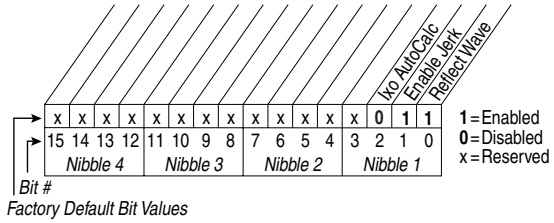
Figure 11.3 Speed Limits



56	Compensation
	Range: See Figure 11.4
	Default: See Figure 11.4
	Access: 2 Path: Motor Control>Torq Attributes
	See also:

Enables/disables the compensation correction options.

Figure 11.4 Compensation (56)


Ixo AutoCalc
Enable Jerk
Reflect Wave
x x x x x x x x x x x x x 0 1 1
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
Bit #
Factory Default Bit Values
1 = Enabled
0 = Disabled
x = Reserved

Bit 0 - Reflect Wave

- Enables/disables reflected wave correction software, which reduces overvoltage transients from the drive to the motor. For lead lenghts beyond 300 feet, enable this feature.

Bit 1 - Enable Jerk

- Enables/disables the jerk limit in the current limiter that helps to eliminate overcurrent trips on fast accelerations. Disable this feature if your application requires the actual acceleration of the motor to be faster than .25 sec.

Bit 2 - Ixo AutoCalc (25 HP and larger)

- Calculates voltage drop due to leakage inductance (see parameter 64).

57	Flux Up Mode
	Range: 0 = Manual 1 = Automatic
	Default: 0 = Manual
	Access: 2 **Path**: Motor Control>Torq Attributes
	See also: 53, 58

Flux-up curent is the amount of DC current equal to current limit, so full flux can be established in the motor before acceleration.

Manual (0): Flux is established for Flux Up Time (58) before acceleration

Auto (1): Flux is established for a calculated time period based on motor nameplate data. Flux Up Time (58) is not used.

58	Flux Up Time
	Range: 0.00 to 5.00 Sec [0.01 Sec]
	Default: 0.0 Sec
	Access: 2 **Path**: Motor Control>Torq Attributes
	See also: 53, 58

Sets the amount of time the drive will use to try to achieve full motor stator flux. When a start command is issued, DC current at current limit level is used to build stator flux before accelerating..

59	SV Boost Filter		
25↑	**Range:**	0 to 32767	
	Default:	500	
	Access:	2	**Path**: Motor Control>Torq Attributes
	See also:		

Sets the amount of filtering used to boost voltage during Sensorless Vector operation.

61	Autotune	
	Range:	0 = Ready 1 = Static Tune 2 = Rotate Tune 3 = Calculate
	Default:	3 = Calculate
	Access:	2 **Path**: Motor Control>Torq Attributes
	See also:	53, 62, 63

Provides a manual or automatic method for setting IR Voltage Drop (62) and Flux Current Ref (63), which affect sensorless vector performance. Valid only when Torque Perf Mode (53) is set to Sensrls Vect or SV Economize.

Ready (0) = Parameter returns to this setting following a Static Tune or Rotate Tune. It also permits manually setting IR Voltage Drop (62) and Flux Current Ref (63).

Static Tune (1) = A temporary command that initiates a non-rotational motor stator resistance test for the best possible automatic setting of IR Voltage Drop. A start command is required following the initiation of this setting. The parameter returns to Ready (0) following the test, at which time another start transition is required to operate the drive in normal mode. Used when the motor cannot be uncoupled from the load.

Rotate Tune (2) = A temporary command that initiates a Static Tune followed by a rotational test for the best possible automatic setting of Flux Current Ref. A start command is required following initiation of this setting. The parameter returns to Ready (0) following the test, at which time another start transition is required to operate the drive in normal mode.

ATTENTION: Rotation of the motor in an undesired direction can occur during this procedure (Autotune (61) = Rotate Tune (2)). To guard against possible injury and/or equipment damage, it is recommended that the motor be disconnected from the load before proceeding.

Important: Rotate Tune (2) is used when motor is uncoupled from the load. Results may not be valid if a load is coupled to the motor during this procedure.

Calculate (3) = This setting uses motor nameplate data to automatically set IR Voltage Drop and Flux Current Ref.

62 **IR Voltage Drop**

Range:	0.0 to Motor NP Volts x 0.25 [0.1V AC]
Default:	Motor NP Volts x 0.25
Access:	2 Path: Motor Control>Torq Attributes
See also:	53

Value of volts dropped across the resistance of the motor stator. Used only when Torque Perf Mode (53) is set to Sensrls Vect or SV Economize. This value can be set by the Autotune procedure.

63 **Flux Current Ref**

32

Range:	0.00 to Motor NP FLA [0.01 Amps]
Default:	Based on Drive Rating
Access:	2 **Path**: Motor Control>Torq Attributes
See also:	53

Value of amps for full motor flux. Used only when Torque Perf Mode (53) is set to Sensrls Vect or SV Economize. This value can be set by the Autotune procedure.

64 **Ixo Voltage Drop**

O

25↑

Range:	0.0 to Motor NP Volts [0.1V AC]
Default:	Based on Drive Rating
Access:	2 **Path**: Motor Control>Torq Attributes
See also:	

Sets the value of the voltage drop due to leakage inductance of the motor. Used only when Torque Perf Mode (53) is set to Sensrls Vect or SV Economize.

69 **Start/Acc Boost**

Range:	0.0 to Motor NP Volts x 0.25 [0.1V AC]
Default:	Motor NP Volts x 0.25
Access:	2 **Path**: Motor Control>Volts per Hertz
See also:	53, 70, 83

Sets the voltage boost level for starting and acceleration when Custom V/Hz mode is selected in Torque Perf Mode (53).

70 **Run Boost**

Range:	0.0 to Motor NP Volts x 0.25 [0.1V AC]
Default:	Motor HP Volts x 0.25
Access:	1 **Path**: Motor Control>Volts per Hertz
See also:	53, 69, 83

Sets the boost level for steady state or deceleration when Fan/Pmp V/Hz or Custom V/Hz modes are selected in Torque Perf Mode (53).

71 **Break Voltage**

Range:	0.0 to Motor NP Volts [0.1V AC]
Default:	Motor NP Volts x 0.25
Access:	2 **Path**: Motor Control>Volts per Hertz
See also:	53, 72, 83

Sets the voltage the drive will output at Break Frequency (72).

72	**Break Frequency**
	Range: 0.0 to 400.0 [0.1 Hz]
	Default: Motor NP Freq x 0.25
	Access: 2 **Path**: Motor Control>Volts per Hertz
	See also: 53, 71, 83

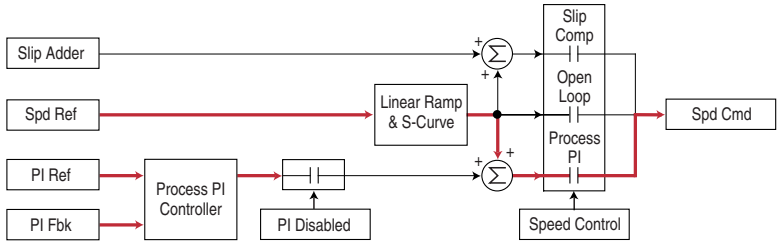
Sets the frequency the drive will output at Break Voltage (71). Applies only in Fan/Pmp V/Hz or Custom V/Hz modes.

80	**Speed Mode**
	Range: 0 = Open Loop 1 = Slip Comp 2 = Process PI
	Default: 0 = Open Loop
	Access: 1 **Path**: Speed Command>Spd Mode & Limits
	See also: 124 -138

Sets the method of speed regulation.

- Open Loop provides no speed compensation due to load variations. This is strict volts per hertz output as a function of the speed reference.
- Slip Comp provides for frequency output adjustment as a function of load. The amount of compensation is defined by the value of Slip RPM @ FLA.
- Process PI allows for the output motor speed (frequency) to be adjusted based on the outer control loop regulator.

Figure 11.5 Speed Control Method



81	**Minimum Speed**
	Range: 0.0 to Maximum Speed [0.1 Hz]
	Default: 0.0 Hz
	Access: 1 **Path**: Speed Command>Spd Mode & Limits
	See also: 83, 92, 95

Sets the low limit for the speed reference after scaling is applied.

ATTENTION: The drive can operate at and maintain zero speed. The user is responsible for assuring safe conditions for operating personnel by providing suitable guards, audible or visual alarms, or other devices to indicate that the drive is operating or may operate at or near zero speed. Failure to observe this precaution could result in severe bodily injury or loss of life.

82 **Maximum Speed**

Range: 5.0 to 400.0 Hz [0.0 Hz]
Default: 50.0 or 60.0 Hz (dependent on voltage class)
Access: 1 **Path**: Speed Command>Spd Mode & Limits
See also: 55, 83, 91, 94, 202

Sets the high limit for the speed reference after scaling is applied.

Maximum Speed + Overspeed Limit must be ≤to Maximum Freq.

ATTENTION: The user is responsible for ensuring that driven machinery, all drive-train mechanisms, and application material are capable of safe operation at the maximum operating speed of the drive. Overspeed detection in the drive determines when the drive shuts down. See Figure 11.6. Failure to observe this precaution could result in bodily injury.

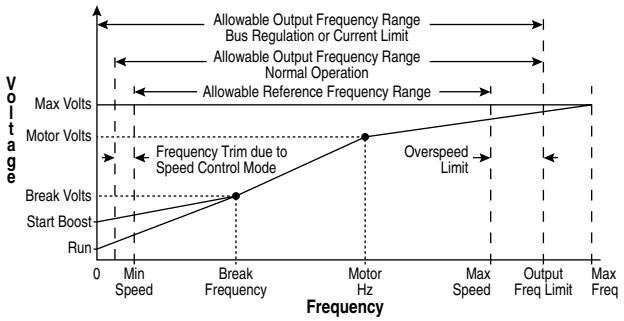
83 **Overspeed Limit**

Range: 0.0 to 20.0 Hz [0.1 Hz]
Default: 10.0 Hz
Access: 2 **Path**: Speed Command>Spd Mode & Limits
See also: 55, 82

Sets the incremental amount of the output frequency (above Maximum Speed) allowable for functions such as slip compensation. See Figure 11.6.

Maximum Speed + Overspeed Limit must be ≤to Maximum Freq.

Figure 11.6 Speed Limits



84 **Skip Frequency 1**
85 **Skip Frequency 2**
86 **Skip Frequency 3**

Range: -/+ 400 Hz [0.1 Hz]
Default: 0.0 Hz
Access: 84=1 **Path**: Speed Command>Spd Mode & Limits
85=2
86=2
See also: 87

Sets a frequency at which the drive will not operate (also called an **avoidance frequency**). Requires that both Skip Frequency 1-3 and Skip Frequency Band (87) be set to a value other than 0.

87	Skip Freq Band	
	Range:	0.0 to 30.0 Hz [0.1 Hz]
	Default:	1.0 Hz
	Access:	2 **Path**: Speed Command>Spd Mode & Limits
	See also:	84, 85, 86

Determines the bandwidth around a skip frequency (half the band above and half the band below the skip frequency).

89	Logic Source Sel	
	Range:	0 = Terminal Blk 1 = Local OIM 2 = DPI Port 2 3 = DPI Port 3 4 = Reserved 5 = Network 6 = Reserved 7 = All Ports
	Default:	1 = Local OIM
	Access:	1 **Path**: Speed Command>Control Src Select
	See also:	90

Important: The drive is shipped with a default configuration of control from the keypad. For drive control from the terminal block inputs, parameter 89, Logic Source Sel, must be set to 0.

ATTENTION: Changing parameter 89 to Terminal Blk or Network while LevelSense Start is enabled may start the drive if a start command is on from the newly selected logic source.

ATTENTION: When LevelSense Start is enabled, the user must ensure that automatic start up of the driven equipment will not cause injury to operating personnel or damage to the driven equipment. In addition, the user is responsible for providing suitable audible or visual alarms or other devices to indicate that this function is enabled and the drive may start at any moment. Failure to observe this precaution could result in severe bodily injury or loss of life.

ATTENTION: Removing and replacing the LCD OIM while the drive is running may cause an abrupt speed change if the LCD OIM is the selected reference source, but is not the selected control source. The drive will ramp to the reference level provided by the OIM at the rate specified in Accel Time 1 (140), Accel Time 2 (141), Decel Time 1 (142) and Decel Time 2 (143). Be aware that an abrupt speed change may occur depending upon the new reference level and the rate specified in these parameters. Failure to observe this precaution could result in bodily injury.

Selects the control source for the following logic commands:

- Start (Run)
- Clear Faults
- Stop

The All Ports selection allows all ports to control the logic command simultaneously.

ATTENTION: Note the following about stop commands:

- A stop command from any attached OIM will always be enabled regardless of the value of Logic Source Sel.
- Network stop commands are effective only when Logic Source Sel is set to Network or All Ports.
- Terminal block stop commands are effective only when Logic Source Sel is set to Terminal Blk or All Ports.

Failure to observe these precautions could result in severe bodily injury or loss of life.

Important: Asserting the terminal block input OIM Control overrides parameter 89.

Important: Asserting the Purge input overrides OIM Control and parameter 89.

90 Speed Ref A Sel

Range:	1 = Analog In 1 2 = Analog In 2 3-8 = Reserved 9 = MOP Level 10 = Reserved 11 = Preset Spd 1 12 = Preset Spd 2 13 = Preset Spd 3 14 = Preset Spd 4 15 = Preset Spd 5 16 = Preset Spd 6 17 = Purge 18 = Local OIM 19 = DPI Port 2 20 = DPI Port 3 21 = Reserved 22 = Network 23 = Reserved
Default:	1 = Analog In 1
Access:	1 **Path**: Speed Command>Speed References Speed Command>Control Src Select
See also:	2, 91-92, 101-107, 117-120, 192-194, 213, 272, 273, 320-327, 361-366

Selects the source of the speed reference to the drive unless Preset Speed 1-6 (101-106) or Purge Speed (107) is selected.

Note that the manual reference command and inputs OIM Control and Purge can override the reference control source.

ATTENTION: Removing and replacing the LCD OIM while the drive is running may cause an abrupt speed change if the LCD OIM is the selected reference source, but is not the selected control source. The drive will ramp to the reference level provided by the OIM at the rate specified in Accel Time 1 (140), Accel Time 2 (141), Decel Time 1 (142) and Decel Time 2 (143). Be aware that an abrupt speed change may occur depending upon the new reference level and the rate specified in these parameters. Failure to observe this precaution could result in bodily injury.

91	**Speed Ref A Hi**
	Range: -/+ Maximum Speed [0.1 Hz]
	Default: Maximum Speed
	Access: 1 **Path**: Speed Command>Speed References
	See also: 82, 92

Scales the upper value of the Speed Ref Sel (90) selection when the source is an analog input. When the value of this parameter is less than Speed Ref A Lo (92), the reference signal will be inverted.

92	**Speed Ref A Lo**
	Range: -/+ Maximum Speed [0.1 Hz]
	Default: 0.0 Hz
	Access: 1 **Path**: Speed Command>Speed References
	See also: 81, 91

Scales the lower value of the Speed Ref A Sel (90) selection when the source is an analog input. When the value of this parameter is greater than Speed Ref A Lo (92), the reference signal will be inverted.

101	**Preset Speed 1**
102	**Preset Speed 2**
103	**Preset Speed 3**
104	**Preset Speed 4**
105	**Preset Speed 5**
106	**Preset Speed 6**
	Range: -/+ Maximum Speed [0.1 Hz]
	Default: See Table 11.A
	Access: 2 **Path**: Speed Command>Discrete Speeds
	See also: 90, 93

Provides an internal fixed speed command value when Speed Ref A = Preset Spd 1-6.

Table 11.A Default Values for Preset Speeds 1-6

Parameter No.	Parameter Name	Default
101	Preset Speed 1	5.0 Hz
102	Preset Speed 2	10.0 Hz
103	Preset Speed 3	20.0 Hz
104	Preset Speed 4	30.0 Hz
105	Preset Speed 5	40.0 Hz
106	Preset Speed 6	50.0 Hz

107 Purge Speed

Range: -/+ Maximum Speed [0.1 Hz]
Default: 5.0 Hz
Access: 1 **Path**: Speed Command>Discrete Speeds
See also: 90, 93

Provides a fixed internal speed similar to 101-106. It is also the frequency the drive uses when the Purge digital input is closed.

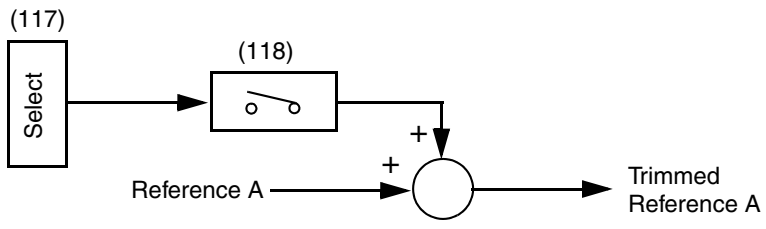
117 Trim In Select

Range:
1 = Analog In 1
2 = Analog In 2
3-8 = Reserved
9 = MOP Level
10 = Reserved
11 = Preset Spd 1
12 = Preset Spd 2
13 = Preset Spd 3
14 = Preset Spd 4
15 = Preset Spd 5
16 = Preset Spd 6
17 = Purge
18 = Local OIM
19 = DPI Port 2
20 = DPI Port 3
21 = Reserved
22 = Network
23 = Reserved

Default: 2 = Analog In 2
Access: 2 **Path:** Speed Command>Speed Trim
See also: 90, 93

Specifies which signal source is being used as a trim input. The trim is an input signal that is added to the reference A signal. If an analog input is used as the trim signal, two scaling parameters are provided.

Figure 11.7 Trim Input Select



118 Trim Out Select

Range:	0 = Not trimmed 1 = Trimmed
Default:	0 = Not trimmed
Access:	2 **Path**: Speed Command>Speed Trim
See also:	117, 119, 120

Specifies if Ref A speed reference is to be trimmed.

119 Trim Hi

Range:	-/+ Maximum Speed [0.1 Hz]
Default:	60.0 Hz
Access:	2 **Path**: Speed Command>Speed Trim
See also:	82, 117

Scales the upper value of the Trim In Select (117) selection when the source is an analog input.

120 Trim Lo

Range:	-/+ Maximum Speed [0.1 Hz]
Default:	0.0 Hz
Access:	2 **Path**: Speed Command>Speed Trim
See also:	117

Scales the lower value of the Trim In Select (117) selection when the source is an analog input.

Important: Parameters in the Slip Comp Group (121-123) are used to enable and tune the slip compensation regulator. To allow the slip compensation regulator to control drive operation, Speed Mode (80) must be set to 1 (Slip Comp).

121 Slip RPM @ FLA

Range:	0.0 to 1200.0 RPM
Default:	Based on Motor NP RPM
Access:	2 **Path**: Speed Command>Slip Comp
See also:	61, 80, 122, 123

Sets the amount of compensation to drive output at motor FLA. If parameter 61 (Autotune) = 3 (Calculate), changes made to this parameter will not be accepted.

122 Slip Comp Gain

Range:	1.0 to 100.0 [0.1]
Default:	40.0
Access:	2 **Path**: Speed Command>Slip Comp
See also:	80, 121, 122

Sets the response time of slip compensation.

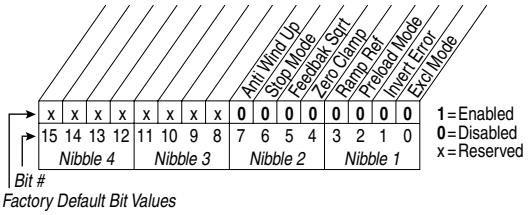
123	Slip RPM Meter	
	Range:	0.0 to 300.0 RPM
	Default:	Read Only
	Access:	2 **Path**: Speed Command>Slip Comp
	See also:	80, 121, 122

Displays the present amount of slip adjustment being added to the motor command frequency.

124	PI Configuration	
	Range:	See Figure 11.8
	Default:	See Figure 11.8
	Access:	2 **Path**: Speed Command>Process PI
	See also:	80, 125-138

Selects specific features of the PI regulator.

Figure 11.8 PI Configuration (124)



Bit 0 - Excl Mode (Exclusive Mode)

- Enabled = Selects speed regulation (PI output used as speed command).
- Disabled = Selects trim regulation (PI output summed with speed command).

Bit 1 - Invert Error

- Enables/disables the option to invert the sign of the PI error signal. Enabling this feature creates a decrease in output for an increasing error and an increase in output for a decreasing error.

Bit 2 - Preload Mode

- Enabled = Initializes the PI integrator to the commanded speed while the PI is disabled.
- Disabled = The PI integrator is loaded with the PI Pre-load (133) while the PI is disabled.

Bit 3 - Ramp Ref

- Enables/disables ramping the PI reference using PI Feedback as the starting point and ramping to the selected PI Reference after PI is enabled. The active accel time is used for the PI ramp reference slew rate. The ramping is bypassed when the reference equals the setpoint. The ramp used is set by the active ramps (parameters 140 to 143).

Bit 4 - Zero Clamp

– Enables/disables option to limit operation so that the output frequency at the PI regulator always has the same sign as the master speed reference. This limits the possible drive action to one direction only. Output from the drive will be from zero to maximum frequency forward or zero to maximum frequency reverse.

Bit 5 - Feedback Sqrt (Square Root Feedback)

– Enables/disables the option of using the square root of the feedback signal as the PI feedback.

Bit 6 - Stop Mode (25 HP and larger)

– When enabled, and a stop command is issued to the drive, the PI loop will continue to operate during the decel ramp.

  When disabled, the drive will perform a normal stop.

Bit 7 - Anti Wind Up (25 HP and larger)

– When enabled, the PI loop will automatically prevent the integrator from creating an excessive error that could cause instability. The integrator will be controlled without the need for PI Reset or PI Hold inputs.

125	**PI Control**	
	Range:	See Figure 11.9
	Default:	See Figure 11.9
	Access:	2 **Path**: Speed Command>Process PI
	See also:	80, 124-138

Controls the PI regulator. You can use a Datalink parameter or an assigned digital input to write to this parameter.

PI control allows the drive to take a reference signal (setpoint) and an actual signal (feedback) and automatically adjust the speed of the drive to match the actual signal to the reference.

Proportional control (P) adjusts the output based on the size of the error (larger error = proportionally larger correction).

Integral control (I) adjusts the output based on the duration of the error. The integral control by itself is a ramp output correction. This type of control gives a smoothing effect to the output and will continue to integrate until zero error is achieved.

By itself, integral control is slower than many applications require, and, therefore, is combined with proportional control (PI).

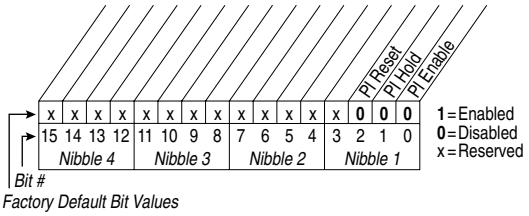
The purpose of the PI regulator is to regulate a process variable such as position, pressure, temperature, or flow rate, by controlling speed.

There are two ways the PI regulator can be configured to operate (see parameter 124):

- Process trim, which takes the output of the PI regulator and sums it with a master speed reference to control the process.
- Process control, which takes the output of the PI regulator as the speed command. No master speed reference exists, and the PI output directly controls the drive output.

Note that Speed Mode (80) must be set to Process PI (2).

Figure 11.9 PI Control (125)


PI Reset
PI Hold
PI Enable
x x x x x x x x x x x x 0 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
Bit #
Factory Default Bit Values
1 = Enabled
0 = Disabled
x = Reserved

Bit 0 - PI Enable

– Enables/disables the operation of the PI loop.

Bit 1 - PI Hold

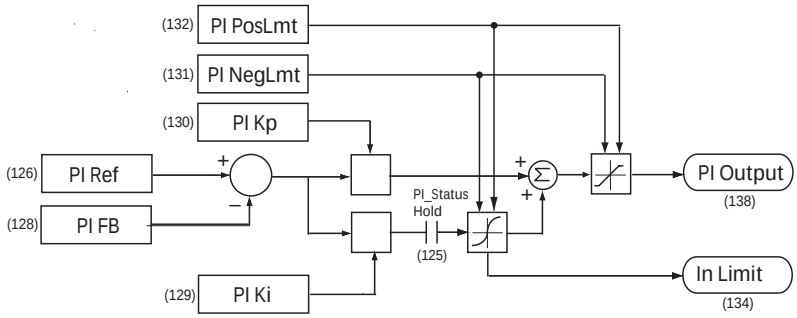
– Enabled = The integrator for the outer control loop is held at the current level; that is, it will not increase.

– Disabled = The integrator for the outer PI control loop is allowed to increase.

Bit 2 - PI Reset

– Enabled = The integrator for the outer PI control loop is reset to zero.

– Disabled = The integrator for the outer PI control loop integrates normally.



126	PI Reference Sel
	Range: 0 = PI Setpoint 1 = Analog In 1 2 = Analog In 2 3-8 = Reserved 9 = MOP Level 10 = Master Ref 11 = Preset Spd 1 12 = Preset Spd 2 13 = Preset Spd 3 14 = Preset Spd 4 15 = Preset Spd 5 16 = Preset Spd 6 17 = Purge 18 = Local OIM 19 = DPI Port 2 20 = DPI Port 3 21 = Reserved 22 = Network 23 = Reserved
	Default: 0 = PI Setpoint
	Access: 2 **Path**: Speed Command>Process PI
	See also: 80, 124-138

Selects the source of the outer control loop process PI reference signal.

127	PI Setpoint
	Range: -/+100.00% of Maximum Process Value [0.01%]
	Default: 50.00%
	Access: 2 **Path:** Speed Command>Process PI
	See also: 80, 124-138

Provides an internal fixed value for the process setpoint when PI Reference Sel (126) is set to PI Setpoint.

128	PI Feedback Sel
	Range: 0 = PI Setpoint 1 = Analog In 1 2 = Analog In 2 3-8 = Reserved 9 = MOP Level 10 = Master Ref 11 = Preset Spd 1 12 = Preset Spd 2 13 = Preset Spd 3 14 = Preset Spd 4 15 = Preset Spd 5 16 = Preset Spd 6 17 = Purge 18 = Local OIM 19 = DPI Port 2 20 = DPI Port 3 21 = Reserved 22 = Network 23 = Reserved
	Default: 2 = Analog In 2
	Access: 2 **Path**: Speed Command>Process PI
	See also: 80, 124-138

Selects the source of the outer control loop process PI feedback signal.

129	PI Integral Time	
	Range:	0.00 to 100.00 Sec [0.01 Sec]
	Default:	2.00 Sec
	Access:	2 **Path**: Speed Command>Process PI
	See also:	80, 124-138

Specifies the time required for the integral component of the PI regulator to reach 100% output. The shorter the integral time, the faster the integrator will read the process error.

130	PI Prop Gain	
	Range:	0.00 to 100.00 [0.01]
	Default:	1.00
	Access:	2 **Path**: Speed Command>Process PI
	See also:	80, 124-138

Sets the value for the PI proportional component when the PI Hold bit of PI Control (125) = Enabled (1).

PI Error x PI Prop Gain = PI Output

131	PI Lower Limit	
	Range:	-/+Maximum Freq
	Default:	–Maximum Freq
	Access:	2 **Path**: Speed Command>Process PI
	See also:	80, 124-138

Sets the lower limit of the PI output. This value must be less than the value set in PI Upper Limit (132).

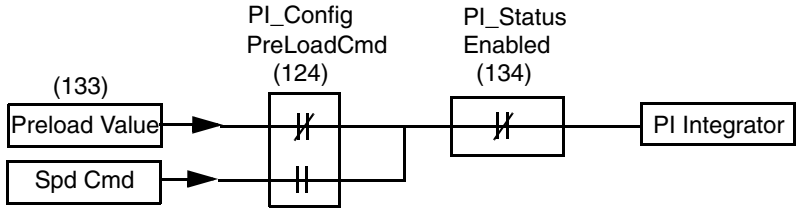
132	PI Upper Limit	
	Range:	-/+Maximum Freq [0.1 Hz]
	Default:	+Maximum Freq
	Access:	2 **Path**: Speed Command>Process PI
	See also:	80, 124-138

Sets the upper limit of the PI output. This value must be greater than the value set in PI Lower Limit (131).

133	PI Preload	
	Range:	-/+Maximum Freq [0.1 Hz]
	Default:	0.0 Hz
	Access:	2 **Path**: Speed Command>Process PI
	See also:	80, 124-138

Sets the value used to load into the PI Integrator when PI is not enabled.

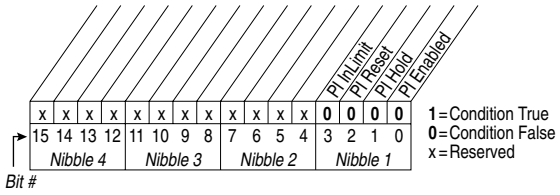
Figure 11.10 PI Preload Value



134	PI Status	
	Range:	See
	Default:	Read Only
	Access:	2 **Path**: Speed Command>Process PI
	See also:	80, 124-138

The present state of the process PI regulator.

Figure 11.11 PI Status (134)


PI InLimit
PI Reset
PI Hold
PI Enabled
x x x x x x x x x x x x 0 0 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
Bit #
1 = Condition True
0 = Condition False
x = Reserved

Bit 0 - PI Enabled

– Indicates whether or not the PI loop is enabled.

Bit 1 - PI Hold

– Is set to 1 to indicate when a digital input is configured for PI Hold and is turned on, or the PI Hold bit is set in PI Control (125).

Bit 2 - PI Reset

– Is set to 1 to indicate when the PI Integrator is being reset to zero.

Bit 3 - PI InLimit

– Is set to 1 to indicate when the PI output equals positive limit or negative limit

135	PI Ref Meter	
	Range:	-/+100.00% [0.01%]
	Default:	Read Only
	Access:	2 **Path**: Speed Command>Process PI
	See also:	80, 124 - 138

Present value of the PI reference signal.

136 PI Fdback Meter

Range:	-/+100.00% [0.01%]
Default:	Read Only
Access:	2 **Path**: Speed Command>Process PI
See also:	80, 124 - 138

Present value of the PI feedback signal.

137 PI Error Meter

Range:	-/+100.00% [0.01%]
Default:	Read Only
Access:	2 **Path**: Speed Command>Process PI
See also:	80, 124 - 138

Present value of the PI error signal.

138 PI Output Meter

Range:	-/+Maximum Freq [0.1 Hz]
Default:	Read Only
Access:	2 **Path**: Speed Command>Process PI
See also:	80, 124 - 138

Present value of the PI output signal.

140 Accel Time 1
141 Accel Time 2

Range:	0.1 to 3600.0 sec [0.1 sec]
Default:	20.0 sec
Access:	140=1 **Path**: Dynamic Control>Ramp Rates 141=2
See also:	56, 142, 143, 146, 361-366

The Accel Time parameters set the rate at which the drive ramps to its output frequency after a start command or during an increase in command frequency (speed change). The rate established is the result of the following equation:

Maximum Frequency - Minimum Frequency / Accel Time = Accel Rate

Two accel times exist to enable acceleration rate changes “on the fly” using a building automation system command, digital input, or F-Key, if configured (see Appendix B).

142 Decel Time 1
143 Decel Time 2

Range:	0.1 to 3600.0 Sec [0.1 sec]
Default:	20.0 sec
Access:	142=1 **Path**: Dynamic Control>Ramp Rates 143=2
See also:	142, 143, 146, 361-366

Sets the rate of deceleration for all speed decreases.

Max Speed / Decel Time = Decel Rate

Two decel times exist to enable deceleration rate changes “on the fly” using a building automation system command, digital input, or F-Key, if configured (see Appendix B).

146	S Curve %
	Range: 0 to 100% [1%]
	Default: 20%
	Access: 1 **Path**: Dynamic Control>Ramp Rates
	See also: 140 - 143

Sets the percentage of acceleration or deceleration time that is applied to the ramp as S Curve. Time is added; 1/2 at the beginning and 1/2 at the end of the ramp.

147	Current Lmt Sel
	Range: 0 = Curr Lim Val 1 = Analog In 1 2 = Analog In 2
	Default: 0 = Cur Lim Val
	Access: 2 **Path**: Dynamic Control>Load Limits
	See also: 148, 149

Selects the source for the adjustment of current limit (i.e., parameter, analog input, etc.). This parameter allows you to set current limit using an external analog signal.

148	Current Lmt Val
	Range: Based on Drive Type [0.1 Amps]
	Default: Based on Drive Type (aprox. 150% of Rated Amps)
	Access: 1 **Path**: Dynamic Control>Load Limits
	See also: 147, 149

Defines the current limit value when Current Lmt Sel (147) = Cur Lim Val.

149	Current Lmt Gain
	Range: 0 to 5000 [1]
	Default: 250
	Access: 2 **Path**: Dynamic Control>Load Limits
	See also: 147, 148

Sets the responsiveness of the current limit.

150	Drive OL Mode
	Range: 0 = Disabled 1 = Reduce CLim 2 = Reduce PWM 3 = Both-PWM 1st
	Default: 3 = Both-PWM 1st
	Access: 1 **Path**: Dynamic Control>Load Limits
	See also: 219

Selects the drive's response to increasing drive temperature. The drive could reduce current limit, PWM carrier, or both. A fault or alarm will be activated if an overload is detected.

151	CarrierFrequency	
	Range:	2 - 10 kHz [1 kHz]
	Default:	4 kHz
	Access:	1 **Path**: Dynamic Control>Load Limits
	See also:	146, 149

Sets the carrier frequency for the PWM output. Drive derating may occur at higher carrier frequencies. For derating information, refer to Appendix A.

155 156	Stop Mode A Stop Mode B	
	Range:	0 = Coast 1 = Ramp 2 = Ramp to Hold 3 = DC Brake
	Default:	155: 0 = Coast 156: 1 = Ramp
	Access:	1 **Path**: Dynamic Control>Stop/Brake Modes
	See also:	157-159, 361-366

Selects active stop mode. Stop Mode A is active unless Stop Mode B is selected by a digital input. This function allows you to switch between two stop modes using an external logic input.

ATTENTION: The user must provide an external, hardwired emergency stop circuit outside of the drive circuitry. This circuit must disable the system in case of improper operation. Uncontrolled machine operation may result if this procedure is not followed. Failure to observe this precaution could result in bodily injury.

157	DC Brake Lvl Sel	
	Range:	0 = DC Brake Lvl 1 = Analog In 1 2 = Analog In 2
	Default:	0 = DC Brake Lvl
	Access:	2 **Path**: Dynamic Control>Stop/Brake Modes
	See also:	155, 156, 158, 159

Selects the source for DC Brake Level (158).

158	DC Brake Level	
	Range:	0 to (Rated Amps x 1.5) [0.1 Amps]
	Default:	Rated Amps
	Access:	2 **Path**: Dynamic Control>Stop/Brake Modes
	See also:	157-159

Defines the maximum DC brake current in percentage of drive rated current.

The DC braking voltage used in this function is created by a PWM algorithm and may not generate the smooth holding force needed for some applications.

ATTENTION: If a hazard of injury due to movement of equipment or material exists, an auxiliary mechanical braking device must be used to stop the motor. Failure to observe this precaution could result in severe bodily injury or loss of life.

ATTENTION: This feature should not be used with synchronous or permanent magnet motors. Motors may be demagnetized during braking. Failure to observe this precaution could result in damage to, or destruction of, equipment.

159 DC Brake Time

Range:	0.0 to 90.0 Sec [0.1 Sec]
Default:	0.0 Sec
Access:	2 **Path**: Dynamic Control>Stop/Brake Modes
See also:	155 - 158

Sets the amount of time DC brake current is “injected” into the motor.

160 Bus Reg Ki (Bus Reg Gain)

Range:	0 to 5000 [1]
Default:	450
Access:	2 **Path**: Dynamic Control>Stop/Brake Modes
See also:	161, 162

Sets the responsiveness of the bus regulator.

161 Bus Reg Mode A
162 Bus Reg Mode B

Range:	0 = Disabled 1 = Adjust Freq 2 = Dynamic Brak 3 = Both - DB 1st 4 = Both - Frq 1st
Default:	Mode A: 1 = Adjust Freq Mode B: 0 = Disabled
Access:	2 **Path**: Dynamic Control>Stop/Brake Modes
See also:	160, 163, 361-366

Sets the method and sequence of the DC bus regulator voltage. Choices are dynamic brake, frequency adjust, or both.

Sequence is determined by programming or digital input to the terminal block.

If a dynamic brake resistor is connected to the drive, Bus Reg Mode A and Bus Reg Mode B must be set to option 2, 3, or 4

ATTENTION: The adjust freq portion of the bus regulator function is extremely useful for preventing nuisance overvoltage faults resulting from aggressive decelerations, overhauling loads, and eccentric loads. It forces the output frequency to be greater than commanded frequency while the drive's bus voltage is increasing towards levels that would otherwise cause a fault. However, it can also cause either of the following two conditions to occur:

- Fast positive changes in input voltage (more than a 10% increase within 6 minutes) can cause uncommanded positive speed changes; however, an OverSpeed Limit fault will occur if the speed reaches Max Speed + Overspeed Limit. If this condition is unacceptable, action should be taken to 1) limit supply voltages within the specification of the drive, and 2) limit fast positive input voltage changes to less than 10%. Without taking such actions, if this operation is unacceptable, the adjust freq portion of the bus regulator function must be disabled (see parameters 161 and 162).
- Actual deceleration times can be longer than commanded deceleration times; however, a Decel Inhibit fault is generated if the drive stops decelerating altogether. If this condition is unacceptable, the adjust freq portion of the bus regulator must be disabled (see parameters 161 and 162). In addition, installing a properly sized dynamic brake resistor will provide equal or better performance in most cases.

Note that these faults are not instantaneous and have shown test results that take between 2 and 12 seconds to occur.

163 DB Resistor Type

Range: 0 = Internal Res
1 = External Res
2 = None

Default: 0 = Internal Res

Access: 2 **Path**: Dynamic Control>Stop/Brake Modes

See also: 161, 162

Selects whether the internal or an external DB resistor will be used.

164 Bus Reg Kp

Range: 0 to 10000

25↑

Default: 1200

Access: 2 **Path**: Dynamic Control>Stop/Brake Modes

See also:

Proportional gain for the bus regulator. Used to adjust regulator response.

165 Bus Reg Kd

Range: 0 to 10000

25↑

Default: 1000

Access: 2 **Path**: Dynamic Control>Stop/Brake Modes

See also:

Derivative gain for the bus regulator. Used to control regulator overshoot.

168	LevelSense Start	
	Range:	0 = Disabled 1 = Enabled
	Default:	1 = Enabled
	Access:	1 **Path**: Dynamic Control>Stop/Restart Modes
	See also:	160, 163

ATTENTION: Be aware of the following:

- Setting parameter 168 to 1 (Enabled) immediately applies output power to the motor when all start conditions are met.
- If the drive is running from the terminal block, LevelSense Start is enabled, and a fault occurs, the drive coasts to rest and generates a fault. In this case, resetting and clearing the fault immediately restarts the drive without any change to the start or stop input states.

When this function is enabled, the user must ensure that automatic start up of the driven equipment will not cause injury to operating personnel or damage to the driven equipment. In addition, the user is responsible for providing suitable audible or visual alarms or other devices to indicate that this function is enabled and the drive may start at any moment. Failure to observe this precaution could result in severe bodily injury or loss of life.

ATTENTION: Disabling this function will alter the operation of the drive or, for drives with the bypass option, inhibit the drive from starting. Do not disable this function. Failure to observe this precaution could result in severe bodily injury or loss of life.

Enables/disables a feature to issue a start or run command and automatically run at the commanded speed when drive input power is applied.

Disabled: The drive starts on the open-to-closed transition of the control source start input when no start inhibit conditions are present (edge-sensitive detection).

Enabled: The drive starts when the control source start input is closed, no start inhibit conditions are present, and power is applied (level-sensitive detection).

Note that this feature (LevelSense Start) requires a digital input configured for run or start and a valid start contact.

169	Flying Start En	
	Range:	0 = Disabled 1 = Enabled
	Default:	1 = Enabled
	Access:	2 **Path**: Dynamic Control>Stop/Restart Modes
	See also:	170

Enables/disables the function which reconnects to a spinning motor at actual RPM when a start command is issued.

Normally, when a drive is started in its normal mode, it initially applies a frequency of 0 Hz and ramps to the desired frequency. If the drive is started into an already

spinning motor in this manner, without Flying Start enabled, large currents will be generated and an overcurrent trip may result.

In Flying Start mode, the drive's response to a start command will be to identify the motor's speed and apply a voltage that is synchronized in frequency, amplitude and phase to the counter emf of the spinning motor. The motor will then accelerate to the desired frequency.

170	Flying StartGain	
	Range:	20 to 32767 [1]
	Default:	4000
	Access:	2 **Path**: Dynamic Control>Stop/Restart Modes
	See also:	169

Adjusts the responsiveness of the flying start function. Increasing the value in this parameter increases the responsiveness of the flying start function.

174	Auto Rstrt Tries	
	Range:	0 to 9 [1]
	Default:	0 (Disabled)
	Access:	1 **Path**: Dynamic Control>Stop/Restart Modes
	See also:	175

ATTENTION: Equipment damage and/or personal injury may result if parameter 174 is used in an inappropriate application. Do not use this function without considering applicable local, national, and international codes, standards, regulations, or industry guidelines.

ATTENTION: The drive may start immediately after a fault is auto-reset when LevelSense Start (168) is set to Enabled.

When LevelSense Start is enabled, the user must ensure that automatic start up of the driven equipment will not cause injury to operating personnel or damage to the driven equipment. In addition, the user is responsible for providing suitable audible or visual alarms or other devices to indicate that this function is enabled and the drive may start at any moment. Failure to observe this precaution could result in severe bodily injury or loss of life.

Important: The drive will re-start after a reset if the start input is still asserted.

Specifies the maximum number of times the drive attempts to reset a fault and restart when the auto restart feature is enabled.

The auto restart feature provides the ability for the drive to automatically perform a fault reset followed by a start attempt without user or application intervention. Only certain faults are permitted to be reset, see chapter 12 for more information.

When the auto restart feature is enabled (that is, Auto Rstrt Tries is set to a value greater than zero), and an auto-resettable fault occurs, the drive will stop. After the number of seconds in Auto Restrt Delay (175) has elapsed, the drive will automatically reset the faulted condition. The drive will then issue an internal start command to start the drive.

If another auto-resettable fault occurs, the cycle will repeat up to the number of attempts specified in Auto Rstrt Tries.

If the drive faults repeatedly for more than the number of attempts specified in Auto Rstrt Tries with less than five minutes between each fault, the drive will remain in the faulted state. The fault Auto Rstrt Tries will be logged in the fault queue.

The auto restart feature is disabled when the drive is stopping and during autotuning. Note that a DC Hold state is considered stopping.

The following conditions will abort the reset/run process:

- Issuing a stop command from any control source. (Note that removal of a 2-wire run-fwd or run-rev command is considered a stop command.)
- Issuing a fault reset command from any active source.
- Removing the enable input signal.
- Setting Auto Restrt Tries to zero.
- Occurrence of a fault that is not auto-resettable.
- Removing power from the drive.
- Exhausting an auto-reset/run cycle.

Note that two autotuning status bits are provided in Drive Status 2 (210): an active status bit and a countdown status bit.

175 **Auto Rstrt Delay**

Range:	0.5 to 30.0 Sec [0.1 Sec]
Default:	30.0 Sec
Access:	1 **Path**: Dynamic Control>Stop/Restart Modes
See also:	174

Sets the time between restart attempts when the auto restart feature is enabled. Refer to Auto Rstrt Tries (174) for more information about the auto restart feature.

178 **Sleep-Wake Mode** (25 HP and Larger)

Range:	0 = Disabled 1 = Direct
Default:	0 = Disabled
Access:	2 **Path**: Dynamic Control>Restart Modes
See also:	

Enables the Sleep-Wake function.

ATTENTION: Enabling the Sleep-Wake function can cause unexpected machine motion during the Wake mode. Do not use this function without considering the information in the table below. Failure to observe this procaution could result in personal injury ot damage to equipment.

Important: When enabled, the following conditions must be met:
• A proper minimum value must be set for Sleep Level (182).
• At least one of the following must be programmed in Digital Inx Sel (361 to 366): Enable, Stop=CF, Run, Run Forward, Run Reverse.

	Start Requirements When Sleep-wake Mode is Enabled			
Configured Digital inputs	**At Power-up**	**After Fault Reset**		**After Stop**
		Stop-CF (OIM or TB)	Clear Faults (TB or PC S'ware	OIM, TB, or Network Stop
Stop	Stop Closed Wake Signal	Stop Closed Wake Signal Start/Run Signal	Stop Closed Wake Signal	Stop Closed Wake Signal Start/Run Signal
Enable	Enable Closed Wake Signal	Enable Closed Wake Signal Start/Run Signal	Enable Closed Wake Signal	Enable Closed Wake Signal Start/Run Signal
Run Run Forward Run Reverse	Wake Signal Run Closed	Wake Signal Run Signal	Wake Signal Run Closed	Wake Signal Run Signal

Sleep-Wake Operation

The basic operation of this function is to start (wake) the drive when an analog signal is greater than or equal to a user-specified wake level and stop the drive when an analog signal is less than or equal to a user-specified sleep level.

Assuming all drive permissive conditions are met, the drive will start when Sleep-Wake Mode (178) is enabled (= Direct) and the absolute value of the Sleep-Wake Ref (179) is greater than the programmed Wake Level (180) for longer than the programmed Wake Time (181).

The drive will stop when the absolute value of the Sleep-Wake Ref (179) is less than the programmed Sleep Level (182) for longer than the programmed Sleep Time (183).

While the drive is measuring the time above Wake Level (180), it will indicate a "Waking" alarm. If Sleep-Wake Ref (179) goes above Sleep Level (182) or below Wake Level (180) the corresponding timer is reset (Wake timer and Sleep timer, respectively).

While the drive is "awake", all other active stop commands will be honored immediately (i.e. no Sleep timer). However, after a stop is commanded, a new start command while Sleep-Wake Ref (179) is above Sleep Level (182) will be required to reset the sleep-wake controller. Similarly, while the drive is “asleep”, the selected logic control source can still start the drive. In this case, the sleep-wake controller must also be reset (stop, then restart with analog input above sleep level).

If Logic Source Sel (089) is set to All Ports, the drive can only be started when Sleep-Wake Ref (179) is greater than Sleep Level (182). Here the sleep-wake controller remains active and does not need to be reset. If no Start signal has been configured to reset the sleep-wake controller, drive power can be cycled to provide the reset function.

Sleep Level (182) and Wake Level (180) are adjustable while the drive is "awake". If these levels are set incorrectly, the "Sleep Config" alarm is set. If the current configuration is not corrected, the drive will stop after the programmed Sleep Time (183).

Even though the Sleep-Wake feature is enabled, the operation of other start modes is unchanged (e.g. if Level Sense Start is set to Enabled, Logic Source Select is set to All Ports, and a start command is asserted, the drive will start immediately after Sleep-Wake Ref (179) reaches the sleep level).

The Sleep-Wake feature can be overridden in additional ways:

- The Purge digital input overrides all Sleep-Wake operations. Asserting Purge will start the drive even if Sleep-Wake Ref (179) is below Sleep Level (182). Negating Purge will cause the drive to stop and Sleep-Wake will be bypassed (the same as any other TB or OIM Stop command). While Purge is active, the Sleep-Wake analog input will not be able to start or stop the drive.
- The OIM Control digital input allows an attached OIM to start the drive by overriding the Sleep-Wake Sleep signal (i.e. the analog input is below the Sleep level). Once overridden by the OIM, the Sleep-Wake analog input will no longer be able to start or stop the drive until it is restarted while the analog input is above the Sleep level.

179	**Sleep-Wake Ref**	
25↑	**Range:**	1 = Analog In 1 2 = Analog In 2
	Default:	2 = Analog In 2
	Access:	2 **Path**: Dynamic Control>Restart Modes
	See also:	

Selects the source of the input controlling the Sleep-Wake function.

180	**Wake Level**	
25↑	**Range:**	Sleep Level to 20.000 mA, 10.000 V [0.001 mA, 0.001 V, based on Anlg In Config (320)]
	Default:	6.000 mA, 6.000 V
	Access:	2 **Path**: Dynamic Control>Restart Modes
	See also:	181

Defines the analog input level that will start the drive.

181	**Wake Time**	
25↑	**Range:**	0.0 to 30.0 sec [0.1 sec]
	Default:	1.0
	Access:	2 **Path**: Dynamic Control>Restart Modes
	See also:	180

Defines the amount of time at or above Wake Level before a start command is issued.

182	**Sleep Level**	
25↑	**Range:**	4.000 mA, 0.000 V to Wake Level [0.001 mA or 0.001 V, based on Anlg In Config [320]]
	Default:	5.000 mA, 5.000 V
	Access:	2 **Path**: Dynamic Control>Restart Modes
	See also:	183

Defines the analog input level that will stop the drive.

183 **Sleep Time**

25↑

Range: 0.0 to 30.0 sec [0.1 sec]

Default: 1.0 sec

Access: 2 **Path**: Dynamic Control>Restart Modes

See also: 182

Defines the amount of time at or below Sleep Level before a stop command is issued.

184 **Power Loss Mode**

Range: 0 = Coast
1 = Decel
2 = Continue
3 = Coast input
4 = Decel input

Default: 0 = Coast

Access: 2 **Path**: Dynamic Control>Stop/Power Loss

See also: 184

Sets the reaction to a loss of input power. Power loss is recognized when:

DC bus voltage is ≤73% of DC Bus Memory and Power Loss Mode is set to Coast.

DC bus voltage is ≤82% of DC Bus Memory and Power Loss Mode is set to Decel.

185 **Power Loss Time**

Range: 0.0 to 60.0 Sec [0.1 Sec]

Default: 0.5 Sec

Access: 2 **Path**: Dynamic Control>Stop/Power Loss

See also: 184

Sets the time that the drive will remain in power loss mode before a fault is issued.

186 **Power Loss Level** (25 HP and above)

2

Range: 0.0 to 999.9 V [0.1 V]

Default: 0.0 V

Access: 2 **Path**: Dynamic Control>Power Loss

See also: 184

Sets the level at which the Power Loss Mode selection will occur.

190 **Direction Mode**

Range: 0 = Unipolar
1 = Bipolar
2 = Reverse Dis

Default: 2 = Reverse Dis

Access: 2 **Path**: Utility>Direction Config

See also: 320 - 327, 361 - 366

Selects the source for control of drive direction.

ATTENTION: Setting parameter 190 to 0 or 1 may cause unwanted motor direction. Verify driven machinery cannot be damaged by reverse rotation before changing the setting of this parameter to 0 or 1. Failure to observe this precaution could result in damage to, or destruction of, equipment.

Unipolar = Drive receives unsigned reference signal and a separate direction command (from a logic source such as digital inputs or a DPI port).

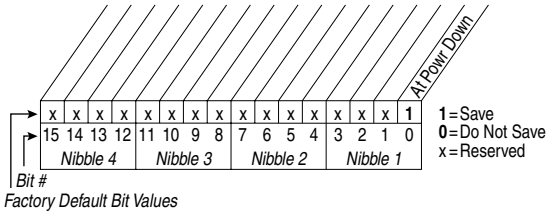
Bipolar = Drive receives signed reference.

Reverse Disable = Drive receives signed reference; however, regardless of the reference, the drive is not permitted to reverse.

192	Save OIM Ref
Range:	See Figure 11.12
Default:	See Figure 11.12
Access:	2 **Path**: Utility>OIM Ref Config
See also:	

Enables a feature to save the present frequency reference value issued by the OIM to drive memory on power loss. Value is restored to the OIM on power up.

Figure 11.12 Save OIM Ref (192)


At Powr Down
x x x x x x x x x x x x x x x 1
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
Bit #
Factory Default Bit Values
1 = Save
0 = Do Not Save
x = Reserved

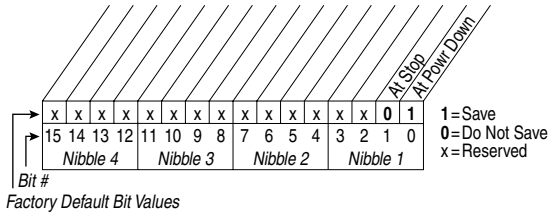
193	Man Ref Preload
Range:	0 = Disabled 1 = Enabled
Default:	0 = Disabled
Access:	2 **Path**: Utility>OIM Ref Config
See also:	320 - 327, 361 - 366

Enables/disables a feature to automatically load the present auto frequency reference value into the OIM when Hand is selected. Allows smooth speed transition from Auto to Hand.

194	Save MOP Ref
Range:	See Figure 11.13
Default:	At Pwrdown
Access:	2 **Path**: Utility>MOP Config
See also:	

Enables/disables the feature that saves the present MOP (motor-operated potentiometer) frequency reference at power down or at stop.

Figure 11.13 Save MOP Ref (194)


At Stop
At Powr Down
x x x x x x x x x x x x x x 0 1
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
Bit #
Factory Default Bit Values
1 = Save
0 = Do Not Save
x = Reserved

195 MOP Rate

Range:	0.2 to Maximum Freq [0.1 Hz/sec]
Default:	1.0 Hz/sec
Access:	2 **Path**: Utility>MOP Config
See also:	

Sets the rate of change of the MOP reference in response to a digital input.

196 Param Access Lvl

Range:	1 = Standard 2 = Advanced
Default:	Read Only
Access:	1 **Path**: Utility>Drive Memory
See also:	

Displays the present parameter access level. Refer to Chapter 10 for more information about parameter access levels.

197 Reset To Defalts

Range:	0 = Ready 1 = Factory 2 = Low Voltage 3 = High Voltage
Default:	0 = Ready
Access:	1 **Path**: Utility>Drive Memory
See also:	

Resets all parameter values to defaults. Option 1 resets the drive to factory settings. Options 2 and 3 resets the drive to alternate voltage and current rating.

Important: On frame 5 drives, the internal fan voltage may have to be changed when using options 2 or 3.

Low Voltage = 400 V class defaults.
HIgh Voltage = 480 V class defaults.

198 Load Frm Usr Set

Range:	0 = Ready 1 = User Set 1 2 = User Set 2 3 = User Set 3
Default:	0 = Ready
Access:	2 **Path**: Utility>Drive Memory
See also:	199

Loads a previously saved set of parameter values from a selected user set location in drive non-volatile memory to active drive memory.

An F-Key on the LCD OIM can be configured for this function. Refer to Appendix B.

199	Save To User Set
	Range: 0 = Ready 1 = User Set 1 2 = User Set 2 3 = User Set 3
	Default: 0 = Ready
	Access: 2 **Path**: Utility>Drive Memory
	See also: 198

Saves the parameter values in active drive memory to a user set in drive non-volatile memory.

An F-Key on the LCD OIM can be configured for this function. Refer to Appendix B.

200	Reset Meters
	Range: 0 = Ready 1 = MWh 2 = Elapsed Time
	Default: 0 = Ready
	Access: 1 **Path**: Utility>Drive Memory
	See also:

Resets selected meters to zero.

201	Language
	Range: 0 = Not Selected 1 = English 2 = French 3 = Spanish 4 = Italian 5 = German 6 = Reserved 7 = Portuguese
	Default: 0 = Not Selected
	Access: 2 **Path**: Utility>Drive Memory
	See also:

Selects the display language when using an LCD OIM.

202	Voltage Class
	Range: 2 = Low Voltage 3 = High Voltage
	Default: Based on Drive Type
	Access: 2 **Path**: Utility>Drive Memory
	See also: 55

Resets selected parameters that change the drive voltage rating, current rating, scaling, and motor data. Maximum Frequency (55) will be affected by changing this parameter.

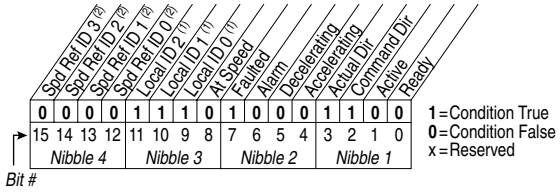
203	Drive Checksum		
	Range:	0 to 65535 [1]	
	Default:	Read Only	
	Access:	2	**Path**: Utility>Drive Memory
	See also:		

Provides a checksum value that indicates whether or not a change in drive programming has occurred (data values only).

209	Drive Status 1		
	Range:	See Figure 11.14	
	Default:	Read Only	
	Access:	2	**Path**: Utility>Diagnostics
	See also:	210	

Present operating condition of the drive.

Figure 11.14 Drive Status 1 (209)



Bits (2)				Description	Bits (1)			Description
15	14	13	12		11	10	9	
0	0	0	0	Ref A Auto	0	0	0	Port 0 (TB)
0	0	0	1	Preset 1 Auto	0	0	1	Port 1
0	0	1	0	Preset 2 Auto	0	1	0	Port 2
0	0	1	1	Preset 3 Auto	0	1	1	Port 3
0	1	0	0	Preset 4 Auto	1	0	0	Port 4
0	1	0	1	Preset 5 Auto	1	0	1	Port 5
0	1	1	0	Preset 6 Auto	1	1	0	Port 6
0	1	1	1	Preset 7 Auto	1	1	1	No Local
1	0	0	0	TB Manual				Control
1	0	0	1	Port 1 Manual				
1	0	1	0	Port 2 Manual				
1	0	1	1	Port 3 Manual				
1	1	0	0	Port 4 Manual				
1	1	0	1	Port 5 Manual				
1	1	1	0	Port 6 Manual				

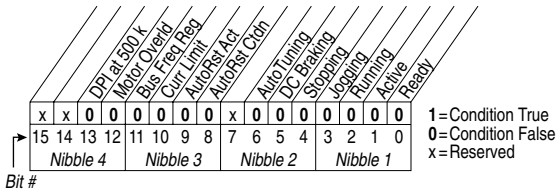
Bit	Function	Description
0	Ready	Drive ready; no faults or inhibits.
1	Active	Drive outputting voltage.
2	Commanded Dir	
3	Active Dir	Motor direction = setpoint direction.
4	Accelerating	Motor accelerating.
5	Decelerating	Motor decelerating.
6	Alarm	Alarm active.
7	Faulted	Drive faulted.
8	At Speed	Output frequency = Setpoint frequency.

210 Drive Status 2

Range: See Figure 11.15
Default: Read Only
Access: 2 **Path**: Utility>Diagnostics
See also: 209

Present operating condition of the drive.

Figure 11.15 Drive Status 2 (210)



Bit	Name	Description
0	Ready	No start inhibits are active.
1	Active	Drive is generating output voltage to the motor.
2	Running	Drive is generating output voltage to the motor, run has been selected.
3	Jogging	Drive is in jog mode.
4	Stopping	Drive is stopping.
5	DC Braking	DC braking is active.
6	Auto Tuning	Tuning function is active.
8	AutoRst Ctdn:	Auto Restart Countdown. Refer to parameter 174.
9	AutoRst Ac:	Auto Restart Active. Refer to parameter 174.
10	Curr Limit:	Drive is in current limit.
11	Bus Freq Reg:	Drive is regulating bus frequency.
12	Motor Overld:	Motor overload is active.
13	DPI @ 500 K	DPI communications is operating at 500 kbaud (1), 125 kbaud (0)

211 Drive Alarm 1

Range: See Figure 11.16

Default: Read Only

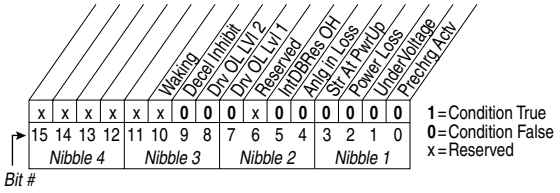
Access: 2 **Path:** Utility>Diagnostics
Utility>Alarms

See also: 212, 259

Indicates Type 1 alarm conditions that currently exist in the drive. Note that for alarm conditions not configured in Alarm Config 1 (259), the status indicated will be a zero.

Refer to Chapter 12, Troubleshooting the Drive, for more information about alarms.

Figure 11.16 Drive Alarm (211)



212 Drive Alarm 2

Range: See Figure 11.17

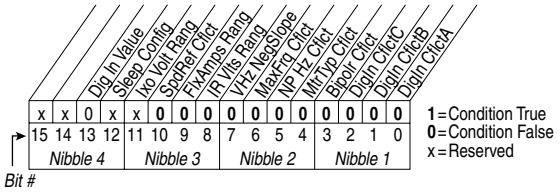
Default: Read Only

Access: 2 **Path:** Utility>Diagnostics
Utility>Alarms

See also: 211

Indicates Type 2 alarm conditions that currently exist in the drive. Refer to Chapter 12, Troubleshooting the Drive, for more information about alarms.

Figure 11.17 Drive Alarm (212)



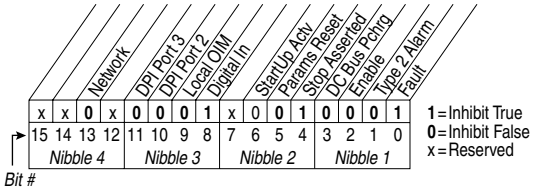
213	Speed Ref Source
Range:	0 = PI Output 1 = Analog In 1 2 = Analog In 2 3-8 = Reserved 9 = MOP Level 10 = Jog Speed 11 = Preset Spd 1 12 = Preset Spd 2 13 = Preset Spd 3 14 = Preset Spd 4 15 = Preset Spd 5 16 = Preset Spd 6 17 = Purge 18 = Local OIM 19 = DPI Port 2 20 = DPI Port 3 21 = Reserved 22 = Network 23 = Reserved
Default:	Read Only
Access:	2 **Path**: Utility>Diagnostics
See also:	90, 93, 96, 101

Displays the source of the speed reference of the drive.

214	Start Inhibits
Range:	See Figure 11.18
Default:	Read Only
Access:	2 **Path**: Utility>Diagnostics
See also:	

Displays the inputs currently preventing the drive from starting.

Figure 11.18 Start Inhibits (214)



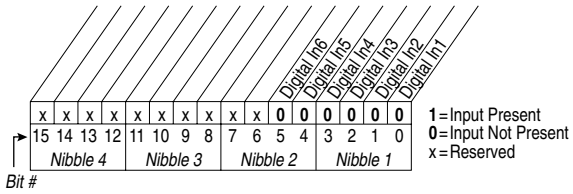
215	Last Stop Source
Range:	0 = Pwr Removed 1 = Local OIM 2 = DPI Port 2 3 = DPI Port 3 4 = Reserved 5 = Network 6 = Reserved 7 = Digital In 8 = Fault 9 = Not Enabled 10 = Sleep 11 = Jog
Default:	Read Only
Access:	2 **Path**: Utility>Diagnostics
See also:	

Displays the source that initiated the most recent stop sequence. It will be cleared (set to 0) during the next start sequence.

216	Dig In Status	
Range:	See Figure 11.19	
Default:	Read Only	
Access:	2	**Path**: Utility>Diagnostics Inputs & Outputs>Digital Inputs
See also:	361-366	

Current state of the digital inputs on the terminal block.

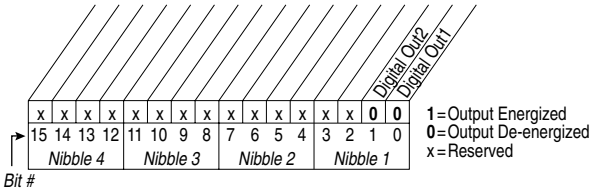
Figure 11.19 Dig In Status (216)


Digital In6
Digital In5
Digital In4
Digital In3
Digital In2
Digital In1
x x x x x x x x x x 0 0 0 0 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
Bit #
1 = Input Present
0 = Input Not Present
x = Reserved

217	Dig Out Status	
Range:	See Figure 11.20	
Default:	Read Only	
Access:	2	**Path**: Utility>Diagnostics Inputs & Outputs>Digital Outputs
See also:	380-384	

Current state of the digital outputs.

Figure 11.20 Dig Out Status (217)


Digital Out2
Digital Out1
x x x x x x x x x x x x x x 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
Bit #
1 = Output Energized
0 = Output De-energized
x = Reserved

218	Drive Temp	
Range:	-/+100 degC [0.1 degC]	
Default:	Read Only	
Access:	2	**Path**: Utility>Diagnostics
See also:		

Present operating temperature of the drive power section.

219	Drive OL Count	
Range:	0.0 to 100.0% [0.1%]	
Default:	Read Only	
Access:	2	**Path**: Utility>Diagnostics
See also:	150	

Accumulated percentage of drive overload. Continuously operating the drive over 100% of its rating will increase this value to 100% and cause a drive fault.

220	Motor OL Count	
	Range:	0.0 to 100.0 % [1.0%]
	Default:	Read Only
	Access:	2 **Path**: Utility>Diagnostics
	See also:	47, 48

Accumulated percentage of motor overload. Continuously operating the motor over 100% of the motor overload setting will increase this value to 100% and cause a drive fault.

224	Fault Frequency	
	Range:	0.0 to +/-400.0 Hz [0.1 Hz]
	Default:	Read Only
	Access:	2 **Path**: Utility>Diagnostics
	See also:	225-230

Captures and displays the output frequency of the drive at the time of the last fault.

225	Fault Amps	
	Range:	0.0 to Rated Amps x 2 [0.1 Amps]
	Default:	Read Only
	Access:	2 **Path**: Utility>Diagnostics
	See also:	224-230

Captures and displays motor amps at the time of the last fault.

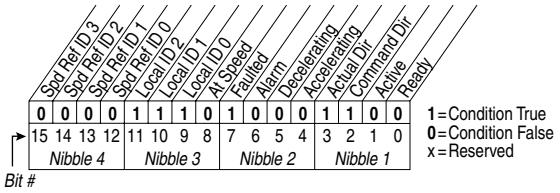
226	Fault Bus Volts	
	Range:	0.0 to Max Bus Volts [0.1 VDC]
	Default:	Read Only
	Access:	2 **Path**: Utility>Diagnostics
	See also:	224-230

Captures and displays the DC bus voltage of the drive at the time of the last fault.

227	Status 1 @ Fault	
	Range:	See Figure 11.21
	Default:	Read Only
	Access:	2 **Path**: Utility>Diagnostics
	See also:	209, 224-230

Captures and displays Drive Status 1 bit pattern at the time of the last fault.

Figure 11.21 Status 1 @ Fault (227)

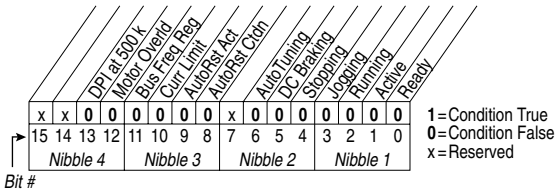


See parameter 209 for bit descriptions.

228	Status 2 @ Fault
Range:	See Figure 11.22
Default:	Read Only
Access:	2 **Path**: Utility>Diagnostics
See also:	210, 224-230

Captures and displays Drive Status 2 bit pattern at the time of last fault.

Figure 11.22 Status 2 @ Fault (228)

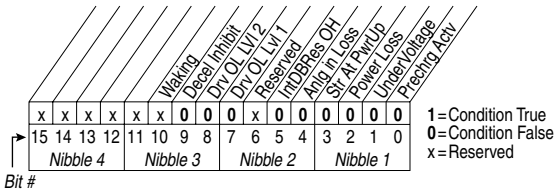


See parameter 210 for bit descriptions.

229	Alarm 1 @ Fault
Range:	See Figure 11.23
Default:	Read Only
Access:	2 **Path**: Utility>Diagnostics
See also:	211, 224-230

Captures and displays Drive Alarm 1 at the time of the last fault.

Figure 11.23 Alarm 1 @ Fault (229)

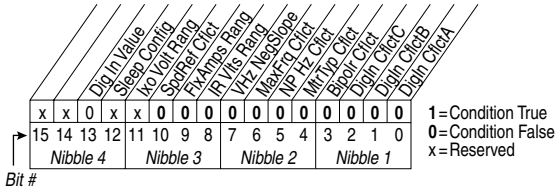


See parameter 211 for bit descriptions.

230	Alarm 2 @ Fault
Range:	See Figure 11.24
Default:	Read Only
Access:	2 **Path**: Utility>Diagnostics
See also:	211, 221-230

Captures and displays Drive Alarm 2 bit pattern at the time of last fault.

Figure 11.24 Alarm 2 @ Fault (230)



See parameter 212 for bit descriptions.

234 Testpoint 1 Sel

Range: 0 to 65535 [1]
Default: 499
Access: 2 **Path**: Utility>Diagnostics
See also: 235

Selects the function whose value is displayed in Testpoint 1 Data (235). These are internal values that are not accessible through parameters.

See Testpoint Codes and Functions in chapter 12 for a list of codes and functions.

235 Testpoint 1 Data

Range: 0 to 4,294,697,295 [1]
Default: 0
Access: 2 **Path**: Utility>Diagnostics
See also: 234

The present value of the function selected in Testpoint 1 Sel (234).

236 Testpoint 2 Sel

Range: 0 to 65535 [1]
Default: 499
Access: 2 **Path**: Utility>Diagnostics
See also: 237

Selects the function whose value is displayed in Testpoint 2 Data (237). These are internal values that are not accessible through parameters.

237 Testpoint 2 Data

Range: 0 to 4,294,967,295 [1]
Default: 0
Access: 2 **Path**: Utility>Diagnostics
See also: 236

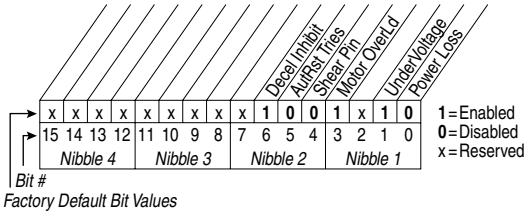
The present value of the function selected in Testpoint 2 Sel (236).

238 Fault Config 1

Range: See Figure 11.25
Default: See Figure 11.25
Access: 2 **Path**: Utility>Faults
See also:

Enables/disables annunciation of the faults shown in Figure 11.25.

Figure 11.25 Fault Config 1 (238)



240 Fault Clear

Range: 0 = Ready
1 = Clear Faults
2 = Clr Flt Que

Default: 0 = Ready

Access: 2 **Path**: Utility>Faults

See also: 241

Resets a fault and clears the fault queue.

241 Fault Clear Mode

Range: 0 = Disabled
1 = Enabled

Default: 1 = Enabled

Access: 2 **Path**: Utility>Faults

See also: 240

Enables/disables a fault reset (clear faults) attempt from any source. This does not apply to fault codes, which are cleared indirectly via other actions.

242 Power Up Marker

32

Range: 0.0000 to 4,294,967.2925 Hr [0.0001 Hr]

Default: Read Only

Access: 2 **Path**: Utility>Faults

See also:

Elapsed hours since initial drive power up. This value will rollover to 0 after the drive has been powered on for more than the maximum value shown.

259 Alarm Config 1

Range: See Figure 11.26

Default: See Figure 11.26

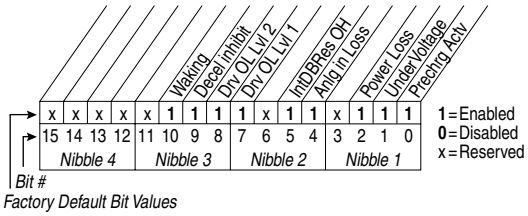
Access: 2 **Path**: Utility>Alarms

See also:

Selects alarm conditions that will initiate a drive alarm.

Refer to Chapter 12, Troubleshooting the Drive, for more information about alarms.

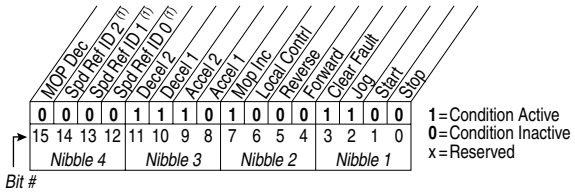
Figure 11.26 Alarm Config 1 (259)



271	Drive Logic Rslt	
	Range:	See Figure 11.27
	Default:	Read Only
	Access:	2 **Path**: Communication>Comm Control
	See also:	

The final logic command to the drive resulting from the combination of all port requests and masking functions. Each bit or set of bits represent a command to the drive or follower device. For VTAC 9 drives, bits 2 and 6 will always = 0.

Figure 11.27 Drive Logc Rslt (271)



Bits(1)			Description
14	13	12	
0	0	0	No Command - Man.
0	0	1	Mode
0	1	0	Ref A Auto
0	1	1	Preset 2 Auto
1	0	0	Preset 3 Auto
1	0	1	Preset 4 Auto
1	1	0	Preset 5 Auto
1	1	1	Preset 6 Auto
			Preset 7 Auto

272	Drive Ref Rslt	
	Range:	0 to 32767 [1]
	Default:	Read Only
	Access:	2 **Path**: Communication>Comm Control
	See also:	

Present frequency reference scaled as a DPI reference for peer-to-peer communications. The value shown is the output prior to the accel/decel ramp and any corrections supplied by slip comp, PI, etc.

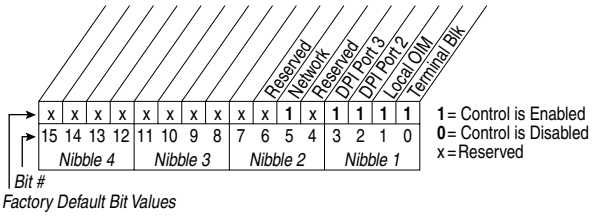
273	Drive Ramp Rslt	
	Range:	0 to 32767 [1]
	Default:	Read Only
	Access:	2 **Path**: Communication>Comm Control
	See also:	

Present frequency reference scaled as a DPI reference for peer-to-peer communications. The value shown is the value after the accel/decel ramp but prior to any corrections supplied by slip comp, PI, etc.

286	Manual Mask
	Range: See Figure 11.28
	Default: 0x2F
	Access: 2 **Path**: Communication>Masks & Owners
	See also:

Disables manual requests at the port corresponding to bit number.

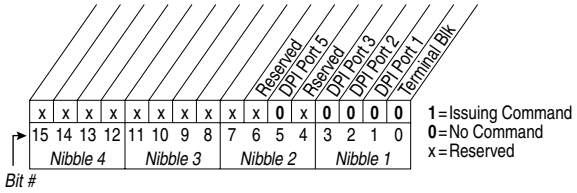
Figure 11.28 Manual Mask (286)



288	Stop Owner
	Range: See Figure 11.29
	Default: Read Only
	Access: 2 **Path**: Communication>Masks & Owners
	See also: 276 - 285

Inputs that are presently issuing a valid stop command.

Figure 11.29 Stop Owner (288)

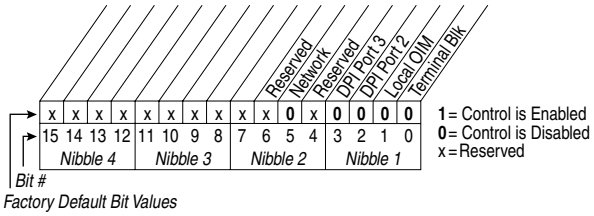

Reserved
DPI Port 5
Reserved
DPI Port 3
DPI Port 2
DPI Port 1
Terminal Blk
x x x x x x x x x 0 x 0 0 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
Bit #
1 = Issuing Command
0 = No Command
x = Reserved

Source	Location
Terminal Block	Logic I/O
DPI Port 1	Local OIM
DPI Port 2	DIN port at base of drive
DPI Port 3	Split DIN port
DPI Port 5 (Network)	Network option

298	Manual Owner
	Range: See Figure 11.30
	Default: Read Only
	Access: 2 Path: Communication>Masks & Owners
	See also:

Indicates the port in manual control.

Figure 11.30 Manual Owner (298)


Reserved
Network
Reserved
DPI Port 3
DPI Port 2
Local OIM
Terminal Blk
x x x x x x x x x x 0 x 0 0 0 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
Bit #
Factory Default Bit Values
1 = Control is Enabled
0 = Control is Disabled
x = Reserved

300 **Data In A1** - Link A Word 1
301 **Data In A2** - Link A Word 2

Range: 0 to 387 [1]
Default: 0 (Disabled)
Access: 2 **Path**: Communication>Datalinks
See also:

Parameter number whose value will be written from a communications device data table.

Parameters that can only be changed while the drive is stopped cannot be used as Datalink inputs. Entering a parameter of this type will disable the link

Refer to the appropriate communications option board manual for datalink information.

302 **Data In B1** - Link B Word 1
303 **Data In B2** - Link B Word 2

Range: 0 to 387 [1]
Default: 0 (Disabled)
Access: 2 **Path**: Communication>Datalinks
See also:

Parameter number whose value will be written from a communications device data table.

Parameters that can only be changed while the drive is stopped cannot be used as Datalink inputs. Entering a parameter of this type will disable the link.

Refer to the appropriate communications option board manual for datalink information.

304 **Data In C1** - Link C Word 1
305 **Data In C2** - Link C Word 2

Range: 0 to 387 [1]
Default: 0 (Disabled)
Access: 2 **Path**: Communication>Datalinks
See also:

Parameter number whose value will be written from a communications device data table.

Parameters that can only be changed while the drive is stopped cannot be used as Datalink inputs. Entering a parameter of this type will disable the link.

Refer to the appropriate communications option board manual for datalink information.

306 **Data In D1** - Link D Word 1
307 **Data In D2** - Link D Word 2

Range: 0 to 387 [1]
Default: 0 (Disabled)
Access: 2 **Path**: Communication>Datalinks
See also:

Parameter number whose value will be written from a communications device data table.

Parameters that can only be changed while the drive is stopped cannot be used as Datalink inputs. Entering a parameter of this type will disable the link.

Refer to the appropriate communications option board manual for datalink information.

310 **Data Out A1**- Link A Word 1
311 **Data Out A2** - Link A Word 2

Range: 0 to 387 [1]
Default: 0 (Disabled)
Access: 2 **Path**: Communication>Datalinks
See also:

Parameter number whose value will be written to a communications device data table.

312 **Data Out B1**- Link B Word 1
313 **Data Out B2** - Link B Word 2

Range: 0 to 387 [1]
Default: 0 (Disabled)
Access: 2 **Path:** Communication>Datalinks
See also:

Parameter number whose value will be written to a communications device data table.

314 **Data Out C1**- Link C Word 1
315 **Data Out C2** - Link C Word 2

Range: 0 to 387 [1]
Default: 0 (Disabled)
Access: 2 **Path**: Communication>Datalinks
See also:

Parameter number whose value will be written to a communications device data table.

316 **Data Out D1**- Link D Word 1
317 **Data Out D2** - Link D Word 2

Range:	0 to 387 [1]		
Default:	0 (Disabled)		
Access:	2	**Path**:	Communication>Datalinks
See also:			

Parameter number whose value will be written to a communications device data table.

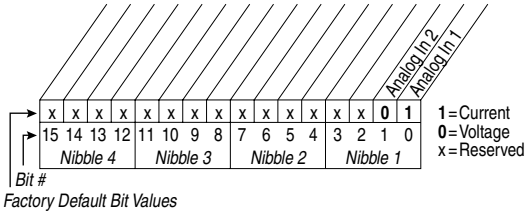
320 **Anlg In Config**

Range:	See Figure 11.31		
Default:	See Figure 11.31		
Access:	1	**Path**:	Inputs & Outputs>Analog Inputs
See also:	322, 323, 325, 326		

Selects the type of input signal being used for analog input 1 and 2.

Note: If bit 1 is set to 1 (voltage), you must set parameters 322 and 323 to re-scale voltage.

Figure 11.31 Anlg In Config (320)


Analog In 2
Analog In 1
x x x x x x x x x x x x x x 0 1
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Nibble 4
Nibble 3
Nibble 2
Nibble 1
1 = Current
0 = Voltage
x = Reserved
Bit #
Factory Default Bit Values

321 **Anlg In Sqr Root**

Range:	See Figure 11.32		
Default:	See Figure 11.32		
Access:	1	**Path**:	Inputs & Outputs>Analog Inputs
See also:			

Enables/disables the square root function for each analog input.

This function should be enabled if the input signal varies with the square of the quantity (i.e., drive speed) being monitored. The square root function is scaled such that the input range is the same as the output range. For example, if the input is set up as a unipolar voltage input, then the input and output ranges of the square root function will be 0 to 10 volts.

Figure 11.32 Anlg In Sqr Root (321)

322 Analog In 1 Hi

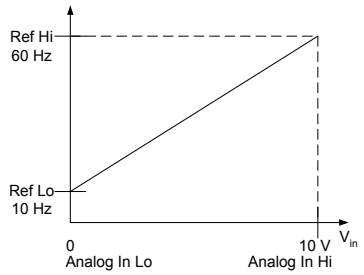
Range:	4.000 to 20.000 mA [0.001 mA] -/+10.0 V [0.1 V] 0.0 to 10.0 V [0.1 V]
Default:	20.000 mA
Access:	1 **Path**: Inputs & Outputs>Analog Inputs
See also:	91, 92, 320, 323

The drive scales the value read from the analog input and converts it to units usable for the application. The user controls the scaling by setting parameters that associate a low and high point in the input range with a low and high point in the target range.

Analog In 1 Hi sets the highest input value to the analog input 1 scaling block.

Note: Note: If bit 1 of Anlg In Config (320) is set to 1, you must use this parameter to re-scale voltage.

Analog Input Scaling Example
Speed Ref A Sel = Analog In 1
Ref. Lo (92) = 10 Hz
Ref. Hi (91) = 60 Hz
Analog In 1 Lo (323) = 0.0 V
Analog In 1 Hi (322) = 10.0 V
This is the default setting, where minimum input (0 V) represents Ref. Lo and maximum input (10 V) represents Ref. Hi.



323 Analog In 1 Lo

Range:	4.000 to 20.000 mA [0.001 mA] -/+10.0 V [0.1 V] 0.0 to 10.0 V [0.1 V]
Default:	4.000 mA
Access:	1 **Path**: Inputs & Outputs>Analog Inputs
See also:	91, 92, 320, 322

Sets the lowest input value to the analog input 1 scaling block. Refer to Analog In 1 Hi (322) for more information.

Note: If bit 1 of Anlg In Config (320) is set to 1, you must use this parameter to re-scale voltage.

324 Analog In 1 Loss

Range:	0 = Disabled 1 = Fault 2 = Hold Input (use last frequency command) 3 = Set Input Lo (use Minimum Speed as frequency command) 4 = Set Input Hi (use Maximum Speed as frequency command) 5 = Goto Preset1 (use Preset 1 as frequency command) 6 = Hold OutFreq (maintain last output frequency)
Default:	0 = Disabled
Access:	1 **Path**: Inputs & Outputs>Analog Inputs
See also:	91, 92

Selects drive response when an analog signal loss is detected. (1.6V = signal loss, 1.9V = end of signal loss; 3.2 mA = signal loss, 3.8 mA = end of signal loss.)

One of the selections (1=Fault) stops the drive on signal loss. All other choices make it possible for the input signal to return to a usable level while the drive is still running.

ATTENTION: Setting parameter 324 to a value greater than 1 allows the input signal to return to a usable level while the drive is running. If a lost analog signal is restored while the drive is running, the drive will ramp to the restored reference level at the rate specified in Accel Time 1 (140), Accel Time 2 (141), Decel Time 1 (142), and Decel Time 2 (143). Be aware that an abrupt speed change may occur depending upon the new reference level and the rate specified in these parameters. Failure to observe this precaution could result in bodily injury.

Important: Note that there is no signal loss detection while the input is in bipolar voltage mode.

325 Analog In 2 Hi

Range:	4.000 to 20.000 mA [0.001 mA] -/+10.0 V [0.1 V] 0.0 to 10.0 V [0.1 V]
Default:	10 V
Access:	2 **Path**: Inputs & Outputs>Analog Inputs
See also:	91, 92, 320, 326

Sets the highest input value to the analog input 2 scaling block.

Note: If bit 0 of Anlg In Config (320) is set to 1, you must use this parameter to re-scale current.

326	Analog In 2 Lo	
	Range:	4.000 to 20.000 mA [0.001 mA] -/+10.0 V [0.1 V] 0.0 to 10.0 V [0.1 V]
	Default:	0.0 V
	Access:	2 **Path**: Inputs & Outputs>Analog Inputs
	See also:	91, 92, 320, 325

Sets the lowest input value to the analog input 2 scaling block.

Note: If bit 0 of Anlg In Config (320) is set to 1, you must use this parameter to re-scale current.

327	Analog In 2 Loss	
	Range:	0 = Disabled 1 = Fault 2 = Hold Input (use last frequency command) 3 = Set Input Lo (use Minimum Speed as frequency command) 4 = Set Input Hi (use Maximum Speed as frequency command) 5 = Goto Preset1 (use Preset1 as frequency command) 6 = Hold OutFreq (maintain last output frequency)
	Default:	0 = Disabled
	Access:	2 **Path**: Inputs & Outputs>Analog Inputs
	See also:	91, 92

Selects drive action when an analog signal loss is detected. (1.6V = signal loss, 1.9 = end of signal loss; 3.2 mA = signal loss, 3.8 mA = end of signal loss.)

One of the selections (1=Fault) stops the drive on signal loss. All other choices make it possible for the input signal to return to a usable level while the drive is still running.

ATTENTION: Setting parameter 327 to a value greater than 1 allows the input signal to return to a usable level while the drive is running. If a lost analog signal is restored while the drive is running, the drive will ramp to the restored reference level at the rate specified in Accel Time 1 (140), Accel Time 2 (141), Decel Time 1 (142), and Decel Time 2 (143). Be aware that an abrupt speed change may occur depending upon the new reference level and the rate specified in these parameters. Failure to observe this precaution could result in bodily injury.

Important: Note that there is no signal loss detection while the input is in bipolar voltage mode.

340	Anlg Out Config	
251↑	**Range:**	0 = Voltage 1 = Current
	Default:	1
	Access:	1 **Path**: Inputs & Outputs>Analog Outputs
	See also:	

Selects the mode for analog outputs.

341	Anlg Out Absolut	
Range:	0 = Disabled 1 = Enabled	
Default:	1	
Access:	2	**Path**: Inputs & Outputs>Analog Outputs
See also:	342	

Selects whether the signed value or absolute value of a parameter is used before being scaled to drive the analog output.

Bit	Signal Level	Output Volts
0	-100% 0% 100%	0 V 5 V 10 V
1	-100% 0% 100%	10 V 0 V 10 V

342	Analog Out1 Sel	
Range:	0 = Output Freq: Output frequency 1 = Command Freq: Commanded frequency setpoint 2 = Output Amps: Total output current 3 = Torque Amps: Torque current 4 = Flux Amps: Flux current 5 = Output Power: Output power 6 = Output Volts: Output voltage 7 = DC Bus Volts: DC Bus voltage 8 = PI Reference: PI setpoint value 9 = PI Feedback: PI feedback value 10 = PI Error: Difference between PI Reference & PI Feedback (reference - feedback) 11 = PI Output: PI output value 12 = % Motor OL: Motor overload percentage 13 = % Drive OL: Drive overload percentage 14 = Post Rmp Ref: Post Ramp Reference value	
Default:	0 = Output Freq	
Access:	1	**Path**: Inputs & Outputs>Analog Outputs
See also:	1 - 7, 12, 135 - 138, 219, 220	

Selects the source of the value that drives the analog output. Refer to table 11.2.

343	Analog Out1 Hi	
Range:	±10.000 V / 4 - 20 mA [0.001 V / .001 mA]	
Default:	10.000 V / 20.000 mA	
Access:	1	**Path**: Inputs & Outputs>Analog Outputs
See also:	342	

Sets the analog output value when the source value is at maximum.

Scaling the Analog Output

The user defines the scaling for the analog output by entering analog output voltages into Analog Out1 Lo and Analog Out1 Hi. These two output voltages correspond to the bottom and top of the possible range covered by the quantity being output. The output voltage will vary linearly with the quantity being output. The analog output voltage will not go outside the limits defined by Analog Out1 Lo and Analog Out 1 Hi. See Table 11.B.

Table 11.B Analog Output Scaling

Options:		Analog Out1 Lo (344) Value Corresponds to:		Analog Out1 Hi (343) Value Corresponds to:
		Analog Out Absolut (341) = Disabled	*Analog Out Absolut (341) = Enabled*	
0	Output Freq	–[Maximum Speed]	0 Hz	+[Maximum Speed]
1	Commanded Freq	–[Maximum Speed]	0 Hz	+[Maximum Speed]
2	Output Amps	0 Amps	0 Amps	200% Rated
3	Torque Amps	–200% Rated	0 Amps	200% Rated
4	Flux Amps	0 Amps	0 Amps	200% Rated
5	Output Power	0 kW	0 kW	200% Rated
6	Output Volts	0 Volts	0 Volts	120% Rated
7	DC Bus Volts	0 Volts	0 Volts	200% Rated
8	PI Reference	–100%	0%	100%
9	PI Feedback	–100%	0%	100%
10	PI Error	–100%	0%	100%
11	PI Output	–100%	0%	100%
12	%Motor OL	0%	0%	100%
13	%Drive OL	0%	0%	100%
14	Post Ramp Ref	–[Maximum Speed]	0 Hz	+[Maximum Speed]

344 Analog Out1 Lo

Range: ±10.000 V / 4 - 20 mA [0.001 V / .001 mA]
Default: 0.000 V / 4.000 mA
Access: 1 **Path**: Inputs & Outputs>Analog Outputs
See also: 342, 343

Sets the analog output value when the source value is at minimum.

Refer to Analog Out1 Hi (343) for more information.

361	**Digital In1 Sel**
362	**Digital In2 Sel**
363	**Digital In3 Sel**
364	**Digital In4 Sel**
365	**Digital In5 Sel**
366	**Digital In6 Sel**

Range:	0 = Not Used 1 = Enable 2 = Clear Faults(1) 3 = Function Loss 4 = Stop - CF(2) 5 = Start 6 = Fwd/Reverse2 7 = Run(3) 8 = Run Forward3 9 = Run Reverse3 10 = Reserved 11 = Reserved 12 = Reserved 13 = Stop Mode B 14 = Bus Reg Md B 15 = Speed Sel 1(4) 16 = Speed Sel 24 17 = Speed Sel 34 18 = Reserved 19 = Reserved 20 = Acc2 & Dec2 21 = Accel 2 22 = Decel 2 23 = MOP Inc 24 = MOP Dec 25 = OIM Control 26 = PI Enable 27 = PI Hold 28 = PI Reset 29 = Pwr Loss Lvl 30 = Precharge En 31 = Purge
Default:	See Table 11.D
Access:	2 **Path**: Inputs & Outpust>Digital Inputs
See also:	124, 140, 156, 162, 194, 380

(1) When Digital In"x" Sel is set to option 2 (Clear Faults), the stop key cannot be used to clear a fault condition.

(2) Typical 3-Wire Inputs. These require that only 3-wire functions are chosen. Including 2-wire selections will cause a type 2 alarm.

(3) Typical 2-Wire Inputs. These require that only 2-wire functions are chosen. Including 3-wire selections will cause a type 2 alarm.

(4) To access Preset Speed 1, set Speed Ref A Sel to Preset Speed 1. See Table 11.C

Table 11.C Speed Select Inputs

Speed Select Inputs			
3	2	1	Reference Source
0	0	0	Speed Ref A Sel
0	0	1	Preset Speed 1
0	1	0	Preset Speed 2
0	1	1	Preset Speed 3
1	0	0	Preset Speed 4
1	0	1	Preset Speed 5
1	1	0	Preset Speed 6
1	1	1	Purge Speed

Assigns an input function to the drive's digital inputs.

Table 11.D Default Values for Parameters 361-388

Parameter No.	Default Value
361	7 = Run
362	2 = Clear Faults
363	3 = Function Loss
364	1 = Enable
365	25 = OIM Control
366	31 = Purge

The input functions are:

1 = Enable: If the input is closed, the drive can run (start permissive). If the input is open, the drive will not start.

If the drive is already running when this input is opened, the drive will coast and indicate "not enabled" on the OIM (if present). This is not considered a fault condition, and no fault will be generated.

If multiple enable inputs are configured, the drive will not run if any of them are open.

2 = Clear Faults: This function allows an external device to reset drive faults through the terminal block if Logic Source Sel (89) is set to Terminal Blk or All Ports. An open-to-closed transition on this input will reset the current fault (if any).

If this input is configured at the same time as Stop-Clear Faults, then only the Clear Faults input can actually cause faults to be reset.

3 = Function Loss: If the function loss input is open, a fault is generated. The function loss input is active at all times regardless of the selected logic control source.

The function loss input is not intended for a fast output power kill. The drive will not fault until the software detects the change of state of this input. If this input function is not configured, the fault will not occur.

4 = Stop - CF (Stop - Clear Faults): An open input will assert a stop command if the terminal block is the control source. While the stop is asserted, the drive ready status will be off. A closed input will allow the drive to start. An open-to-closed transition is interpreted as a clear faults request. The drive will clear any existing faults.

If Start is configured, then Stop-Clear Faults must also be configured to prevent a digital input configuration alarm condition. Stop-Clear Faults is optional in all other circumstances.

5 = Start: An open-to-closed transition generates a run command if the terminal block is the control source.

If Start is configured, then Stop-Clear Faults must also be configured to prevent a digital input configuration alarm condition.

6 = Fwd/Reverse (Forward/Reverse): An open input sets the direction to forward if the terminal block is the control source. A closed input sets the direction to reverse. If the state of the input changes and the drive is running, the drive will change direction.

If the Fwd/Rev input function is assigned to more than one physical digital input at a time, a digital input configuration alarm will be asserted.

7 = Run: An open-to-closed transition on this input generates a a run command if the terminal block is the control source. If the input is open, the drive will stop.

8 and **9 = Run Forward** and **Run Reverse:** If the terminal block is the control source, an open-to-closed transition on one or both inputs while the drive is stopped will cause the drive to run unless the Stop - Clear Faults input function is configured and open.

If one or both of these input functions are assigned to more than one physical digital input at a time, a digital input configuration alarm will be asserted.

13 = Stop Mode B: This digital input selects between two different drive stop modes.

If the input is open, then Stop Mode A selects which stop mode to use. If the input is closed, the Stop Mode B selects which stop mode to use. If this input function is not configured, then Stop Mode A selects which stop mode to use.

14 = Bus Regulation Mode B: This digital input function selects how the drive will regulate excess voltage on the DC bus.

If the input is open, then Bus Reg Mode A selects which bus regulation mode to use. If the input is closed, then Bus Reg Mode B selects which bus regulation mode to use. If this input function is not configured, then Bus Reg Mode A selects which bus regulation mode to use.

15-17 = Speed Select 1, 2, 3: One, two, or three digital input functions can be used to select the speed reference used by the drive, and they are called the Speed Select input functions. The current open/closed state of all Speed Select input functions combine to select which source is the current speed reference.

There are 7 possible combinations of open/closed states for the three input functions, and thus 7 possible parameters can be selected. The 7 parameters are: Speed Ref A Sel, Preset Speed 2 through Preset Speed 6, and Purge Speed.

If the Speed Select input functions select Speed Ref A Sel , then the value of that parameter further selects a reference source. There are a large number of possible selections, including all 5 presets.

If the input functions directly select one of the preset speed parameters, then the parameter contains a frequency that is to be used as the reference.

The Speed Select input function configuration process involves assigning the functionality of the three possible Speed Select input functions to physical digital inputs. The three Speed Select inputs functions are called Speed Select 1, Speed Select 2, and Speed Select 3, and they are assigned to physical inputs using the Digital In"x" Sel parameters.

Table 11.E describes the various reference sources that can be selected using all three of the Speed Select input functions. If any of the three Reference Select input functions are not configured, then the software will still follow the table, but will treat the unconfigured inputs as if they are permanently open.

Table 11.E Reference Source Selections

Speed Select 3	Speed Select 2	Speed Select 1	Parameter that determines reference:
Open	Open	Open	Speed Ref A Sel
Open	Open	Closed	Preset Speed 1
Open	Closed	Open	Preset Speed 2
Open	Closed	Closed	Preset Speed 3
Closed	Open	Open	Preset Speed 4
Closed	Open	Closed	Preset Speed 5
Closed	Closed	Open	Preset Speed 6
Closed	Closed	Closed	Purge Speed

20 = Acc2 & Dec2: A single input function is used to select between Accel Time 1/ Decel Time 1 and Accel Time 2/Decel Time2.

If the function is open, the drive will use Accel Time 1 as the acceleration rate and Decel Time 1 as the deceleration rate. If the function is closed, the drive will use Accel Time 2 as the acceleration rate and Decel Time 2 as the deceleration rate.

21, 22 = Accel 2, Decel 2: One input function (called Accel 2) selects between Accel Time 1 and Accel Time 2, and another input function (called Decel 2) selects between Decel Time 1 and Decel Time 2. The open state of the function selects Accel Time 1 or Decel Time 1, and the closed state selects Accel Time 2 or Decel Time 2.

23, 24 = MOP Increment, MOP Decrement: The MOP is a reference setpoint (called the MOP Value) that can be incremented and decremented by external devices. These inputs are used to increment and decrement the Motor Operated Potentiometer (MOP) value inside the drive. The MOP value will be retained through a power cycle.

While the MOP Increment input is closed, the MOP value will increase at rate contained in MOP Rate. Units for rate are Hz per second.

While the MOP Decrement input is closed, MOP value will decrease at rate contained in MOP Rate. Units for rate are Hz per second.

If both the MOP Increment and MOP Decrement inputs are closed, the MOP value will stay the same.

In order for the drive to use the MOP value as the current speed reference, either Speed Ref A Sel must be set to MOP.

25 = OIM Control: This input provides a mean to override the logic control source selection and can be used to override control from any port, including the All Ports selection.

An open-to-closed transition of this input sets the control source to the local OIM. If no local OIM is present, the control source is set to the remote OIM. If no OIM is present at all, the drive stops.

When control is set to the OIM, the OIM is granted Hand (manual) reference (the Man Ref Preload (193) configuration is enforced). Subsequent Auto/Hand commands will toggle the OIM in and out of Hand (manual) mode. The drive's active or stopped state is not affected unless no OIM is present.

On a closed-to-open transition, manual control is released if active, and the selected auto reference is used. The logic source select override is removed. The edge/level-sense start configuration is imposed (LevelSense Start).

26 = PI Enable: If this input function is closed, the operation of the Process PI loop will be enabled.

If this input function is open, the operation of the Process PI loop will be disabled.

27 = PI Hold: If this input function is closed, the integrator for the Process PI loop will be held at the current value; that is, it will not increase.

If this input function is open, the integrator for the Process PI loop will be allowed to increase.

28 = PI Reset: If this input function is closed, the integrator for the Process PI loop will be reset to 0.

If this input function is open, the integrator for the Process PI loop will integrate normally.

29 = Pwr Loss Lvl: When the DC bus level in the drive falls below a certain level, a "powerloss" condition is created in the drive logic. This input allows the user to select between two different "power loss" detection levels dynamically. If the physical input is closed, then the drive will take its power loss level from a parameter. If the physical input is open (de-energized), then the drive will use a power loss level designated by internal drive memory, typically 82% of nominal. If the input function is not configured, then the drive always uses the internal power loss level.

30 = Prechange En: This input function is used to manage disconnection from a common DC bus.

If the physical input is closed, this indicates that the drive is connected to common DC bus and normal precharge handling can occur, and that the drive can run (start permissive). If the physical input is open, this indicates that the drive is disconnected from the common DC bus, and thus the drive should enter the precharge state (precharge relay open) and initiate a coast stop immediately in order to prepare for reconnection to the bus.

If this input function is not configured, then the drive assumes that it is always connected to the DC bus, and no special precharge handling will be done.

31 = Purge: This function provides a means of starting the drive at a preset speed (Purge Speed) regardless of the selected control source. The drive is typically configured for level-sense control (LevelSense Start = Enabled) when using this function.

Purge supersedes the OIM Control function as well as any other control command to take control of the drive. Purge can occur, and is operational, at any time whether the drive is running or stopped regardless of the selected logic source selection.

Note that if any start inhibit condition is present, the drive will not start on the purge input transition.

Type 2 Alarms

Some digital input programming may cause conflicts that result in a Type 2 alarm. For example, Digital In1 Sel set to 5 (Start) in 3-wire control, and Digital In2 Sel set to 7 (Run) in 2-wire control. Refer to chapter 12 for more information about these alarms. Note that Type 2 alarms will prevent the drive from starting.

Dig In Status (116) indicates the current state of the digital inputs.

380	**Digital Out1 Sel**	
	Range	1 = Fault - A fault has occurred and stopped the drive 2 = Alarm - A Type 1 or Type 2 alarm condition exists 3 = Ready - The drive is powered, Enabled and no start inhibits exist. It is “ready” to run 4 = Run - The drive is outputting voltage and frequency to the motor (indicates 3–wire control, either direction) 5 = Forward Run - The drive is outputting voltage and frequency to the motor (indicates 2–wire control in forward) 6 = Reverse Run - The drive is outputting voltage and frequency to the motor (indicates 2–wire control in reverse) 7 = Auto Restart - The drive is currently executing the Auto Restart or “Run at Power Up” function 8 = Reserved 9 = At Speed - The commanded speed equals or exceeds the programmed limit 10 = At Freq - The drive output frequency equals or exceeds the programmed limit 11 = At Current - The drive total output current exceeds the programmed limit 12 = At Torque - The drive output torque current component exceeds the programmed limit 13 = At Temp - The drive operating temperature exceeds the programmed limit 14 = At Bus Volts - The drive bus voltage exceeds the programmed limit 15 = At PI Error - The drive Process PI Loop error exceeds the programmed limit 16 = DC Braking - The drive is currently executing either a “DC Brake” or a “Ramp to Hold” stop command and the DC braking voltage is still being applied to the motor. 17 = Curr Limit - The drive is currently limiting output current 18 = Economize - The drive is currently reducing the output voltage to the motor to attempt to reduce energy costs during a lightly loaded situation. 19 = Motor Overld - The drive is currently reducing the output voltage to the motor to attempt to reduce energy costs during a lightly loaded situation. 20 = Power Loss - The drive has monitored DC bus voltage and sensed a loss of input AC power that caused the DC bus voltage to fall below the fixed monitoring value (82% of [DC bus Memory (13) 21 = Input 1 Link - The digital input value is output on Dig Out1 22 = Input 2 Link 23 = Input 3 Link 24 = Input 4 Link 25 = Input 5 Link 26 = Input 6 Link 27 = TB in Manual - The terminal block has manual reference control
	Default:	1 = Fault
	Access:	1 **Path**: Inputs & Outputs>Digital Outputs
	See also:	1-4, 12, 48, 53, 137, 147, 157, 184, 218, 381-383, 385, 386

Selects the drive status that will energize an output relay.

381 Dig Out1 Level

Range:	0.0 to 819.2 [0.1]	
Default:	0.0	
Access:	1	**Path**: Inputs & Outputs>Digital Outputs
See also:	380	

Sets the relay activation level for options 10-15 in Digital Out"x" Sel. Units are assumed to match the above selection (i.e., At Freq = Hz, At Torque = Amps).

382 Dig Out1 OnTime

Range:	0.00 to 600.00 Sec [0.01 Sec]	
Default:	0.00 Sec	
Access:	2	**Path**: Inputs & Outputs>Digital Outputs
See also:	380	

Sets the on delay time for the digital outputs. This is the time between the occurrence of a condition and activation of the relay.

383 Dig Out1 OffTime

Range:	0.00 to 600.00 Sec [0.01 Sec]	
Default:	0.00 Sec	
Access:	2	**Path**: Inputs & Outputs>Digital Outputs
See also:	380	

Sets the off delay time for the digital outputs. This is the time between the disappearance of a condition and de-activation of the relay.

384 **Digital Out2 Sel**

Range:
1 = Fault - A fault has occurred and stopped the drive
2 = Alarm - A Type 1 or Type 2 alarm condition exists
3 = Ready - The drive is powered, Enabled and no start inhibits exist. It is “ready” to run
4 = Run - The drive is outputting voltage and frequency to the motor (indicates 3–wire control, either direction)
5 = Forward Run - The drive is outputting voltage and frequency to the motor (indicates 2–wire control in forward)
6 = Reverse Run - The drive is outputting voltage and frequency to the motor (indicates 2–wire control in reverse)
7 = Auto Restart - The drive is currently executing the Auto Restart or “Run at Power Up” function
8 = Reserved
9 = At Speed - The commanded speed equals or exceeds the programmed limit
10 = At Freq - The drive output frequency equals or exceeds the programmed limit
11 = At Current - The drive total output current exceeds the programmed limit
12 = At Torque - The drive output torque current component exceeds the programmed limit
13 = At Temp - The drive operating temperature exceeds the programmed limit
14 = At Bus Volts - The drive bus voltage exceeds the programmed limit
15 = At PI Error - The drive Process PI Loop error exceeds the programmed limit
16 = DC Braking - The drive is currently executing either a “DC Brake” or a “Ramp to Hold” stop command and the DC braking voltage is still being applied to the motor.
17 = Curr Limit - The drive is currently limiting output current
18 = Economize - The drive is currently reducing the output voltage to the motor to attempt to reduce energy costs during a lightly loaded situation.
19 = Motor Overld - The drive is currently reducing the output voltage to the motor to attempt to reduce energy costs during a lightly loaded situation.
20 = Power Loss - The drive has monitored DC bus voltage and sensed a loss of input AC power that caused the DC bus voltage to fall below the fixed monitoring value (82% of [DC bus Memory (13)
21 = Input 1 Link - The digital input value is output on Dig Out1
22 = Input 2 Link
23 = Input 3 Link
24 = Input 4 Link
25 = Input 5 Link
26 = Input 6 Link
27 = TB in Manual - The terminal block has manual reference control

Default: 4 = Run

Access: 1 **Path**: Inputs & Output>Digital Outputs

See also: 1 - 4, 12, 48, 53, 137, 147, 157, 184, 218, 381-383, 385, 386

Selects the drive status that will energize an output relay.

385 **Dig Out2 Level**

Range: 0.0 to 819.2 [0.1]

Default: 0.0

Access: 1 **Path**: Inputs & Output>Digital Outputs

See also: 380

Sets the relay activation level for options 10-15 in Digital Out"x" Sel. Units are assumed to match the above selection (i.e., At Freq = Hz, At Torque = Amps).

386 Dig Out2 OnTime

Range:	0.00 to 600.00 Sec [0.01 Sec]
Default:	0.00 Sec
Access:	2 **Path**: Inputs & Output>Digital Outputs
See also:	380

Sets the on delay time for the digital outputs. This is the time between the occurrence of a condition and activation of the relay

387 Dig Out2 OffTime

Range:	0.00 to 600.00 Sec [0.01 Sec]
Default:	0.00 Sec
Access:	2 **Path**: Inputs & Output>Digital Outputs
See also:	380

Sets the off delay time for the digital outputs. This is the time between the disappearance of a condition and de-activation of the relay.

Troubleshooting the Drive

ATTENTION: Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate, or service this equipment. Read and understand this manual and other applicable manuals in their entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.

The VTAC 9 drive provides the following ways to determine the status of the drive and to troubleshoot problems that may occur:

- Ready LED on the drive cover
- User-configurable and non-configurable alarms
- User-configurable and non-configurable faults
- Entries in the fault queue
- Drive status parameters

Verifying that DC Bus Capacitors are Discharged Before Servicing the Drive

ATTENTION: DC bus capacitors retain hazardous voltages after input power has been disconnected. After disconnecting input power, wait five (5) minutes for the DC bus capacitors to discharge and then check the voltage with a voltmeter to ensure the DC bus capacitors are discharged before touching any internal components. Failure to observe this precaution could result in severe bodily injury or loss of life.

The drive's DC bus capacitors retain hazardous voltages after input power has been disconnected. Perform the following steps before touching any internal components.

❑ Step 1. Turn off and lock out input power. Wait 5 minutes.

❑ Step 2. Remove the drive's cover.

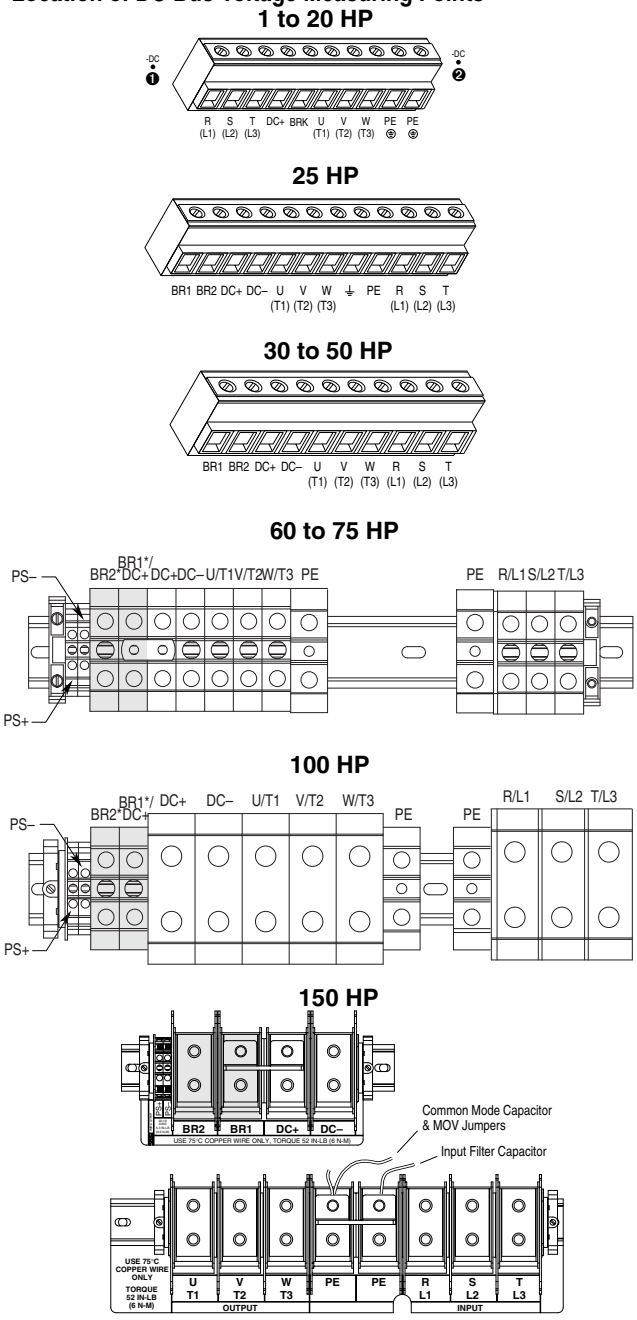
❑ Step 3. Verify that there is no voltage at the drive's input power terminals.

❑ Step 4. Measure the DC bus potential with a voltmeter while standing on a non-conductive surface and wearing insulated gloves. Refer to Figure 12.1.

❑ Step 5. Once the drive has been serviced, reattach the drive's cover.

❑ Step 6. Reapply input power.

Figure 12.1 Location of DC Bus Voltage Measuring Points


1 to 20 HP
-DC
-DC
R (L1) S (L2) T (L3) DC+ BRK U (T1) V (T2) W (T3) PE PE
25 HP
BR1 BR2 DC+ DC– U (T1) V (T2) W (T3) PE R (L1) S (L2) T (L3)
30 to 50 HP
BR1 BR2 DC+ DC– U (T1) V (T2) W (T3) R (L1) S (L2) T (L3)
60 to 75 HP
PS–
BR1*/ BR2*DC+ DC+DC– U/T1 V/T2 W/T3 PE
PE R/L1 S/L2 T/L3
PS+
100 HP
PS–
BR1*/ BR2*DC+ DC+ DC– U/T1 V/T2 W/T3 PE
PE R/L1 S/L2 T/L3
PS+
150 HP
BR2 BR1 DC+ DC–
USE 75°C COPPER WIRE ONLY, TORQUE 52 IN-LB (6 N-M)
Common Mode Capacitor & MOV Jumpers
Input Filter Capacitor
USE 75°C COPPER WIRE ONLY
TORQUE 52 IN-LB (6 N-M)
U T1 V T2 W T3 PE PE R L1 S L2 T L3
OUTPUT
INPUT

Determining Precharge Board Status Using the LED Indicators (Drives 60 HP and Larger)

The precharge board LEDs are located above the Line Type jumper shown in Figure 12.2.

Figure 12.2 Location of Precharge Status LED

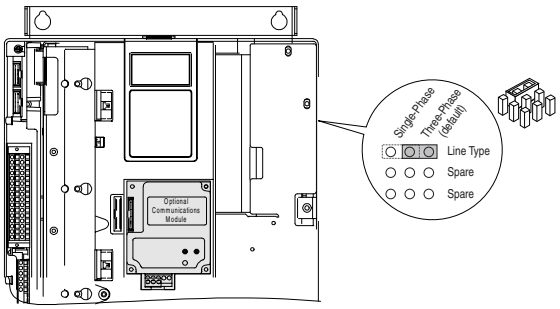


Table 12.A Precharge Board LED Indicators

Name	Color	State	Description
Power ON	Green	Steady	Indicates when pre-charge board power supply is operational
Alarm	Yellow	Steady	Indicates one of the following alarms occurred causing the pre-charge to momentarily stop firing: • Line Loss • Low Phase (single-phase dropped below 80% of line voltage) • Input frequency out of range (momentarily) **Note:** An alarm condition automatically resets when the condition no longer exists
Fault	Red	Steady	Indicates one of the following faults: • DC Bus short • DC Bus not charged • Input frequency out of range • Overtemperature **Note:** A fault indicates a malfunction that needs to be corrected prior to restarting. A fault condition is only reset after cycling power.

Determining Drive Status Using the Ready LED

Figure 12.3 Location of the Ready LED

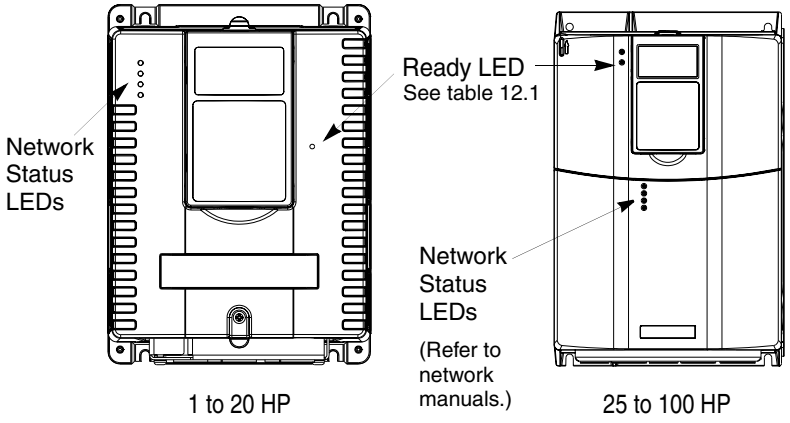


Table 12.B Ready LED Status Definitions

Color	State	Description
Green	Flashing	Drive ready, but not running and no faults are present.
	Steady	Drive running, no faults are present.

Color	State	Description
Yellow	Flashing	The drive is not ready. Check parameter 214 (Start Inhibits).
	Steady	An alarm condition exists. Check parameters 211 (Drive Alarm 1) and 212 (Drive Alarm 2).
Red	Flashing	A fault has occurred.
	Steady	A non-resettable fault has occurred.

About Alarms

Alarms indicate conditions that may affect drive operation or application performance.

There are two alarm types, as described in table Table 12.C.

Table 12.C Alarm Types

Type	Alarm Description	
❶	User-Configurable	These alarms alert the operator of conditions that, if left untreated, may lead to a fault condition. The drive continues to operate during the alarm condition. The alarms are enabled or disabled using Alarm Config 1 (259). The status of these alarms is shown in Drive Alarm 1 (211).
❷	Non-Configurable	These alarms alert the operator of conditions caused by improper programming and prevent the drive from starting until the problem is resolved. These alarms are always enabled. The status of these alarms is shown in Drive Alarm 2 (212).

The drive indicates alarm conditions in the following ways:

- Ready LED on the drive cover (see table Table 12.B on page 12-3).
- Alarm name and bell graphic on the LCD OIM (see Appendix B). The alarm is displayed as long as the conditon exists. The drive automatically clears the alarm when the condition causing it is removed.
- Alarm status parameters. Two 16-bit parameters, Drive Alarm 1 (211) and Drive Alarm 2 (212), indicate the status of type 1 and type 2 alarms, respectively. Refer to chapter 11 for the parameter descriptions.

About the Alarm Queue

Important: This information applies only to drives 25 HP and up (frames 2 and 3).

The drive automatically retains a history of alarms that have occurred in the alarm queue. The alarm queue is accessed using the OIM or PC software.

The alarm queue holds the eight most recent alarms. The last alarm to occur is indicated in queue entry #1. As new alarms are logged into the queue, existing alarm entries are shifted (for example, entry #1 will move to entry #2). Once the queue is full, older alarms are discarded from the queue as new alarmts occur.

All entries in the alarm queue are retained if power is lost. Alarms are automatically cleared when the alarm condition goes away.

The alarm queue can be cleared using the OIM by selecting “Clr Alarm Queue”, or by using a PC software tool.

Alarm Descriptions

Alarm	Type	Description
Analog In Loss	❶	An analog input is configured for alarm on signal loss and signal loss has occurred.
Bipolar Conflict	❷	Parameter 190 (Direction Mode) is set to Bipolar or Reverse Dis and one of more of the following digital input functions is configured: Fwd/Rev or Run Fwd. Note that the VTAC 9 default is Reverse Dis.
Decel Inhibit		The drive is being inhibited from decelerating.
Dig In ConflictA	❷	Digital input functions are in conflict. Combinations marked with a will cause an alarm.
Dig In ConflictB	❷	Digital input functions are in conflict. Combinations marked with a will cause an alarm.
Dig In ConflictC	❷	More than one physical input has been configured to the same input function. Multiple configurations are not allowed for the following input functions:
DigIn Bad Value	❷	Unsupported function selected in Digital In"x" Sel parameters (361-366).
Drive OL Level 1	❶	The calculated IGBT temperature requires a reduction in PWM carrier frequency. If Drive OL Mode (150) is disabled and the load is not reduced, an overload fault will eventually occur.
Drive OL Level 2	❶	The calculated IGBT temperature requires a reduction in Current Limit. If Drive OL Mode (150) is disabled and the load is not reduced, an overload fault will eventually occur.
Flux Amps Ref Rang	❷	Result of autotune procedure (61).
IntDBRes OvrHeat	❶	The drive has temporarily disabled the dynamic braking regulator because the resistor temperature has exceeded a predetermined value.
IR Volts Range	❷	The drive autotuning default is Calculate and the value calculated for IR Drop Volts is not in the range of acceptable values. This alarm should clear when all motor nameplate data is properly entered.
Ixo Vlt Rang		Motor leakage inductance is out of range.
MaxFreq Conflict	❷	The sum of Maximum Speed (82) and Overspeed Limit (83) exceeds Maximum Freq (55). Raise Maximum Freq (55) or lower Maximum Speed (82) and/or Overspeed Limit (83) so that the sum is less than or equal to Maximum Freq (55).
Motor Type Cflct	❷	Motor Type (40) has been set to Sync Prm Mag or Sync Reluc, and one or more DC functions (for example, DC Boost, DC Brake, etc.) have been activated. DC injection functions are imcompatible with synchronous motors and may demagnetize them.

	Acc2 / Dec2	Accel 2	Decel 2	Fwd / Rev
Acc2 / Dec2		✓	✓	
Accel 2	✓			
Decel 2	✓			
Fwd / Rev				

	Start	Stop–CF	Run	Run Fwd	Fwd/Rev
Start			✓	✓	
Stop–CF					
Run	✓			✓	
Run Fwd	✓		✓		✓
Fwd / Rev				✓	

Forward/Reverse	Run	Bus Regulation Mode B
Speed Select 1	Stop Mode B	Acc2 / Dec2
Speed Select 2	OIM Control	Accel 2
Speed Select 3	Purge	Decel 2
Run Forward	Stop Mode B	

Alarm	Type	Description
NP Hz Conflict	❷	Fan/pump mode is selected in Torq Perf Mode (53), and the ratio of Motor NP Hertz (43) to Maximum Freq (55) is greater than 26.
Power Loss	❶	Drive has sensed a power line loss.
Prechrg Actv	❶	Drive is in the initial DC bus precharge state.
Sleep Config		Sleep/Wake configuration error. When Sleep-Wake Mode [178] = Direct, possible causes include: - Drive is stopped and Wake Level [180] < Sleep Level [182] - Digital Inx Sel [361 to 366] is not set to one of the following: Stop=CF, Run, Run Forward, or Run Reverse.
Speed Ref Cflct	❷	Speed Ref A Sel (90) or PI Reference Sel (126) is set to Reserved.
Under-Voltage	❶	The bus voltage has dropped below a predetermined value.
VHz Neg Slope	❷	Custom V/Hz mode has been selected in Torq Perf Mode (53) and the V/Hz slope is negative.
Waking		The wake timer is counting toward a value that will start the drive.

Table 12.D Alarm Names Cross-Referenced by Alarm Numbers

No.(1)	Alarm	No.1	Alarm
1	Precharge Active	20	Bipolar Conflict
2	UnderVoltage	21	Motor Type Conflict
3	Power Loss	22	NP Hz Conflict
5	Analog In Loss	23	MaxFreq Conflict
6	IntDBRes OvrHeat	24	VHz Neg Slope
8	Drive OL Level 1	25	IR Volts Range
9	Drive OL Level 2	26	FluxAmps Ref Rang
10	Decel Inhibit	27	Speed Ref Cflct
11	Waking	28	Ixo Vlt Rang
17	Dig In ConflictA	29	Sleep Config
18	Dig In ConflictB	30	DigIn Bad Value
19	Dig In ConflictC		

(1) Alarm numbers not listed are reserved for future use.

About Faults

Faults indicate conditions within the drive that require immediate attention. The drive responds to a fault by initiating a coast-to-stop sequence and turning off output power to the motor.

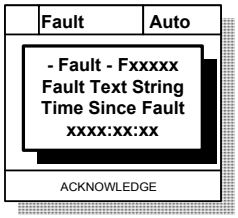
In addition, some faults are auto-resettable, non-resettable, and/or user-configurable as described in table Table 12.D.

Type	Fault Description	
❶	Auto-Reset/Run	If the drive is running when this type of fault occurs, and Auto Rstrt Tries (174) is set to a value greater than 0, a user-configurable timer, Auto Rstrt Delay (175) begins. When the timer reaches zero, the drive attempts to automatically reset the fault. If the condition that caused the fault is no longer present, the fault will be reset and the drive will be restarted.
❷	Non-Resettable	This type of fault normally requires drive or motor repair. The cause of the fault must be corrected before the fault can be cleared. The fault will be reset on power up after repair.
❸	User-Configurable	These faults can be enabled/disabled to either annunciate or ignore a fault condition using Fault Config 1 (238).

The drive indicates faults in the following ways:

- Ready LED on the drive cover.
- Drive status parameters [Drive Status 1] (209) and [Drive Status 2] (210).
- Entries in the fault queue (see section Section).
- Pop-up screen on the LCD OIM. The screen displays:
  - Fault number
  - Fault name
  - Time that has elapsed since fault occurred.

Figure 12.4 Sample Fault Screen on the LCD OIM



The fault screen is displayed until it is acknowledged by pressing any F-key or cleared in the drive by other means.

About the Fault Queue

The drive automatically retains a history of faults that have occurred in the fault queue. The fault queue is accessed using the OIM or PC software.

The fault queue holds the four most recent faults (eight in frames 2 and 3). The last fault to occur is indicated in queue entry #1. As new faults are logged into the queue, existing fault entries are shifted (for example, entry #1 will move to entry #2). Once the queue is full, older faults are discarded from the queue as new faults occur.

All entries in the fault queue are retained if power is lost.

The Time Stamp

For each entry in the fault queue, the system also displays a fault code and time stamp value. The time stamp value is the value of an internal drive-under-power timer at the time of the fault. The value of this timer is copied to PowerUp Marker (242) when the drive powers up. The fault queue time stamp can then be compared to the value in PowerUp Marker to determine when the fault occurred relative to the last drive power up.

The time stamp is cleared when the fault queue is cleared.

Refer to section Section for information on accessing the fault queue using the LCD OIM. Refer to instruction manual D2-3488 for information on accessing the fault queue using PC software.

Clearing Faults

A fault condition can be cleared by the following:

Step 1. Press ESC/PROG or any F-Key to acknowledge the fault and remove the fault pop-up from the LCD OIM screen.

Step 2. Address the condition that caused the fault. The cause must be corrected before the fault can be cleared.

Step 3. After corrective action has been taken, clear the fault using one of the following:

- [Setting Fault Clear] (240) to [Clear Faults] (1).
- Press F1 (Cflt) from the fault queue screen.
- Issuing a Stop-Clear Faults command from the control source.

Resetting faults will clear the faulted status indication. If any fault condition still exists, the fault will be latched, and another entry made in the fault queue.

Note that performing a fault reset does not clear the fault queue. Clearing the fault queue is a separate action. See the Fault Clear (240) parameter description.

Fault Descriptions and Corrective Actions

Table 12.E describes drive faults and corrective actions. It also indicates if the fault is

❶ Auto-resettable

❷ Non-resettable

❸ User-configurable

Table 12.E Fault Descriptions and Corrective Actions

Fault	No.	Type	Description	Action
Analog In Loss	29	❶ ❸	An analog input is configured to fault on signal loss. A signal loss has occurred. Configure with Anlg In 1, 2 Loss (324, 327).	Check parameters. Check for broken/loose connections at inputs.
Anlg Cal Chksum	108	❷	The checksum read from the analog calibration data does not match the checksum calculated.	Replace drive.
Auto Rstrt Tries	33	❸	Drive unsuccessfully attempted to reset a fault and resume running for the programmed number of Auto Rstrt Tries (174). Enable/disable with Fault Config 1 (238).	Correct the cause of the fault and manually clear.
AutoTune Aborted	80		The autotune procedure was canceled by the user.	Restart procedure.
DB Resistance	69		Resistance of the internal DB resistor is out of range.	Replace resistor.
Decel Inhibit	24	❸	The drive is not following a commanded deceleration because it is attempting to limit bus voltage.	Verify input voltage is within drive specified limits. Verify system ground impedance follows proper grounding techniques. Disable bus regulation and/or add dynamic brake resistor and/or extend deceleration time.
Drive OverLoad	64		Drive rating of 110% for 1 minute or 150% for 3 seconds has been exceeded.	Reduce load or extend Accel Time (140).
Excessive Load	79		Motor did not come up to speed in the allotted time.	Uncouple load from motor. Repeat Autotune (61).
FluxAmpsRef Rang	78		The value for flux amps determined by the autotune procedure exceeds the programmed Motor NP FLA (42).	Reprogram Motor NP FLA (42) with the correct motor nameplate value. Repeat Autotune (61).
Function Loss	2	❶	Function loss input is open.	Check remote wiring.
Ground Fault	13	❶	A current path to earth ground in excess of 2A has been detected at one or more of the drive output terminals.	Check the motor and external wiring to the drive output terminals for a grounded condition.
Heatsink OvrTemp	8	❶	Heatsink temperature exceeds a predefined value of 90° C (195° F).	Check for blocked or dirty heat sink fins. Verify that ambient temperature has not exceeded 40° C (104° F) NEMA Type 1 installations or 50°C (122°F) for Open type installations. Check fan.
HW OverCurrent	12	❶	The drive output current has exceeded the hardware current limit.	Check programming. Check for excess load, improper DC boost setting, DC brake volts set too high or other causes of excess current. Motor dynamics cannot be accommodated by autotuning. Manual tuning of the current loop required. Consult technical support.
Incompat MCB-PB	106	❶	Drive rating information stored on the power board is incompatible with the Main Control board.	Load compatible version files into drive.
I/O Comm Loss	121	❷	Loss of communication to I/O board.	Cycle power.
I/O Board Fail	122		Board failure.	Cycle power. If fault repeats, replace I/O board
I/O Mismatch	120		Incorrect I/O board identified.	Restore I/O board to original configuration, or If new configuration is desired, reset fault.
IR Volts Range	77		The drive autotuning default is Calculate and the value calculated for IR Drop Volts is not in the range of acceptable values.	Re-enter motor nameplate data.

Fault	No.	Type	Description	Action
Motor Overload	7	❶ ❸	Internal electronic overload trip. Enable/disable with Fault Config 1 (238).	An excessive motor load exists. Reduce load so drive output current does not exceed the current set by Motor NP FLA (42).
OverSpeed Limit	25	❶	Functions such as slip compensation or bus regulation have attempted to add an output frequency adjustment greater than that programmed in Overspeed Limit (83).	Remove excessive load or overhauling conditions or increase Overspeed Limit (83).
OverVoltage	5	❶	DC bus voltage exceeded maximum value.	Monitor the AC line for high line voltage or transient conditions. Bus overvoltage can also be caused by motor regeneration. Extend the decel time or install dynamic brake option.
Parameter Chksum	100	❷	The checksum read from the board does not match the checksum calculated.	Restore defaults. Reload user set if used.
Params Defaulted	48		The drive was commanded to write default values to EEPROM.	Clear the fault or cycle power to the drive. Program the drive parameters as needed.
Phase Imbalance	37		Phase current displayed in Imbalance Display (221) > percentage set in Imbalance Limit (49) for time set in Imbalance Time (50).	Clear fault.
Phase U to Grnd	38		A phase-to-ground fault has been detected between the drive and motor in this phase.	Check the wiring between the drive and motor. Check motor for grounded phase. Replace drive.
Phase V to Grnd	39			
Phase W to Grnd	40			
Phase UV Short	41		Excessive current has been detected between these two output terminals.	Check the motor and drive output terminal wiring for a shorted condition. Replace drive.
Phase VW Short	42			
Phase UW Short	43			
Port 1-6 DPI Loss	81-86		DPI port stopped communicating. An attached peripheral with control capabilities via Logic Source Sel (89) (or OIM control) was removed. The fault code indicates the offending port number (81 = port 1, etc.)	If adapter was not intentionally disconnected, check wiring to the port. Replace wiring, port expander, adapters, Main Control board or complete drive as required. Check OIM connection.
Port 1-6 Net Loss	71-76		The network card connected to DPI port stopped communicating. The fault code indicates the offending port number (71 = port 1, etc.)	Check communication adapter board for proper connection to external network. Check external wiring to adapter on port. Verify external network fault.
Power Loss	3	❶ ❸	DC bus voltage remained below 85% of nominal for longer than Power Loss Time (185). Enable/disable with Fault Config 1 (238).	Monitor the incoming AC line for low voltage or line power interruption.
Power Unit	70		One or more of the output transistors were operating in the active region instead of desaturation. This can be caused by excessive transistor current or insufficient base drive voltage.	Check for damaged output transistors. Replace drive.
Pwr Brd Chksum1	104		The checksum read from the EEPROM does not match the checksum calculated from the EEPROM data.	Clear the fault or cycle power to the drive.
Pwr Brd Chksum2	105	❷	The checksum read from the board does not match the checksum calculated.	Cycle power to the drive. If problem persists, replace drive.
Replaced MCB-PB	107	❷	Main Control board was replaced and parameters were not programmed.	Restore defaults. Reprogram parameters.
Shear Pin	63	❸	Programmed Current Lmt Val (148) has been exceeded. Enabled/disable with Fault Config 1 (238).	Check load requirements and Current Lmt Val (148) setting.

Fault	No.	Type	Description	Action
SW OverCurrent	36	❶	The drive output current has exceeded the software current.	Check for excess load, improper DC boost setting. DC brake volts set too high.
Trnsistr OvrTemp	9	❶	Output transistors have exceeded their maximum operating temperature.	Check for blocked or dirty heat sink fins. Verify that ambient temperature has not exceeded 40° C (104° F) for NEMA Type 1 installations or 50°C (122°F) for Open type installations. Check fan.
UnderVoltage	4	❶ ❸	DC bus voltage fell below the minimum value of 160V DC at 200/240V input, 300V DC at 400/480V input or 375V DC at 575V input. Enable/disable with Fault Config 1(233).	Monitor the incoming AC line for low voltage or power interruption.
UserSet1 Chksum	101	❷	The checksum read from the user set does not match the checksum calculated.	Re-save user set.
UserSet2 Chksum	102	❷		
UserSet3 Chksum	103	❷		

Table 12.F Fault Names Cross-Referenced by Fault Number

No.(1)	Fault
2	Function Loss
3	Power Loss
4	UnderVoltage
5	OverVoltage
7	Motor Overload
8	Heatsink OvrTemp
9	Trnsistr OvrTemp
12	HW OverCurrent
13	Ground Fault
24	Decel Inhibit
25	OverSpeed Limit
29	Analog In Loss
33	Auto Rstrt Tries
36	SW OverCurrent
37	Phase Imbalance

No.1	Fault
38	Phase U to Grnd
39	Phase V to Grnd
40	Phase W to Grnd
41	Phase UV Short
42	Phase VW Short
43	Phase UW Short
48	Params Defaulted
63	Shear Pin
64	Drive Overload
69	DB Resistance
70	Power Unit
71-76	Port 1-6 Net Loss
77	IR Volts Range
78	FluxAmpsRef Rang
79	Excessive Load

No.1	Fault
80	AutoTune Aborted
81-86	Port 1-6 DPI Loss
100	Parameter Chksum
101	UserSet1 Chksum
102	UserSet2 Chksum
103	UserSet3 Chksum
104	Pwr Brd Chksum1
105	Pwr Brd Chksum2
106	Incompat MCB-PB
107	Replaced MCB-PB
108	Anlg Cal Chksum
120	I/O Board Mismatch
121	I/O Board Comm Loss
122	I/O Board Fail
207	Gate Kill

(1) Fault numbers not listed are reserved for future use.

Diagnostic Parameters

The diagnostic parameters shown in Table 12.G are not accessible using the OIM. They can be accessed only by using a PC software tool (under Device Properties, Diagnostic tab).

Table 12.G Diagnostic Parameters

Diagnostic Parameter	Name
1	DPI Error Status
2	Heatsink Temperature
3	Active Current Limit
4	Active PWM Frequency
5	Lifetime MegaWatt Hours(1)
6	Lifetime Run Time
7	Lifetime Powered Up Time
8	Lifetime Power Cycles
9	Life MegaWatt Hours Fraction(1)
10	Life MegaWatt Hours Fraction Units(1)

Diagnostic Parameter	Name
11-99	Reserved for Factory Use

(1) Use the equation below to calculate total Lifetime MegaWatt Hours.

$$\left(\frac{\text{Value of Code 9}}{\text{Value of Code 10}} \times 0.1\right) + \text{Value of Code 5} = \text{Total Lifetime MegaWatt Hours}$$

Common Symptoms and Corrective Actions

Table 12.H Drive Does Not Start From Start or Run Inputs Wired to the Terminal Block

Indication(s)	Cause(s)	Corrective Action
Flashing red Ready LED.	Drive is faulted.	Clear fault: Press OIM stop key if that OIM is control source. Cycle power. Set Fault Clear (240) to 1. Toggle terminal block stop or terminal block reset digital input if terminal block is kthe control source.
Incorrect operation from the terminal block.	Incorrect input wiring. 2-wire control requires Run, Run Forward, or Run Reverse input(s). 3-wire control requires Start and Stop inputs Jumper from terminal 7 to 8 is required.	Wire inputs correctly and/or install jumper.
	Incorrect digital input programming. Mutually exclusive choices have been made. 2-wire and 3-wire programming may be conflicting. Exclusive functions (i.e, direction control) may have multiple inputs configured. Stop if factory default and is not wired or is open. Start or Run programming may be missing.	Program Digital In"x" Sel (361-366) for correct inputs.
	Logic Source Sel is not set to Terminal Blk.	Set Logic Source Sel to Terminal Blk.
Flashing yellow Ready LED and DigIn CflctB indication on LCD OIM. Drive Status 2 (210) shows type 2 alarm(s).	Incorrect digital input programming. Mutually exclusive choices have been made. 2-wire and 3-wire programming may be conflicting. Exclusive functions (i.e, direction control) may have multiple inputs configured. Stop if factory default and is not wired or is open. Start or Run programming may be missing.	Program Digital In"x" Sel (361-366) to resolve conflicts. Remove multiple selections for the same function. Install stop button to apply a signal at stop terminal.

Table 12.I Drive Does Not Start From OIM

Indication	Cause(s)	Corrective Action
None	Drive is programmed for 2-wire control and Logic Source Sel (89) = All Ports. OIM start and network start are disabled for 2-wire control.	If 2-wire control is required, no action is necessary. If 3-wire control is required, program Digital Inx Sel (361-366) for correct inputs.
Flashing or steady red Ready LED.	Active fault.	Reset fault.
Flashing yellow Ready LED.	Enable input is open.	Close terminal block enable input.
	The terminal block stop input is open and control source is set to All Ports.	Close terminal block stop input.
	Start inhibit bits are set.	Check status in Start Inhibits (214).
Drive Status 1 (209) indicates logic control source.	Logic Source Sel (89) is not equal to the desired OIM (Local OIM, DPI Port 2, or DPI Port 3).	Verify setting of Logic Source Sel (89). The OIM Control digital input effectively sets the control source to the lowest attached OIM port.

Table 12.J Drive Does Not Respond to Changes in Speed Command

Indication	Cause(s)	Corrective Action
LCD OIM Status Line indicates “At Speed” and output is 0 Hz.	No value is coming from the source of the command.	If the source is an analog input, check wiring and use a meter to check for presence of signal. Check Commanded Freq (2) for correct source.
None	Incorrect reference source has been programmed.	Check Speed Ref Source (213) for the source of the speed reference. Reprogram Speed Ref A Sel (90) for correct source.
None	Incorrect reference source is being selected via remote device or digital inputs.	Check Drive Status 1 (209), bits 12 - 15 for unexpected source selections. Check Dig In Status (216) to see if inputs are selecting an alternate source. Reprogram digital inputs to correct Speed Sel x option.

Table 12.K Motor and/or Drive Will Not Accelerate to Commanded Speed

Indication	Cause(s)	Corrective Action
Acceleration time is excessive.	Incorrect value in Accel Time “x” (140, 141).	Reprogram Accel Time “x” (140, 141).
Drive is forced into current limit, slowing or stopping acceleration.	Excess load or short acceleration time.	Check Drive Status 2 (210), bit 10 to see if the drive is in current limit. Remove excess load or reprogram Accel Time “x” (140, 141).
Speed command source or value is not as expected.	Improper speed command.	Check for the proper speed command using steps 1 through 7 in Table 12.J.
Programming is preventing the drive output from exceeding limiting values.	Incorrect programming.	Check Maximum Speed (82) and Maximum Freq (55) to insure that speed is not limited by programming.

Table 12.L Motor Operation is Unstable

Indication	Cause(s)	Corrective Action
None	Motor data was incorrectly entered or autotune was not performed.	1. Correctly enter motor nameplate data. 2. Perform static or rotate autotune procedure (61).

Table 12.M Stopping the Drive Results in a Decel Inhibit Fault

Indication	Cause(s)	Corrective Action
Decel Inhibit fault screen. LCD status line indicates Faulted.	The bus regulation feature is enabled and is halting deceleration due to excessive bus voltage. Excess bus voltage is normally due to excessive regenerated energy or unstable AC line input voltages. Internal timer has halted drive operation.	1. Reprogram bus regulation (parameters 161 and 162) to eliminate any Adjust Freq selection. 2. Disable bus regulation (parameters 161 and 162) and add a dynamic brake. 3. Correct AC input line instability or add an isolation transformer. 4. Reset drive.

Replacement Parts

Table 12.N OIMs and Cables

Description	Part Number
LCD OIM	RE1LCDH
Remote LCD OIM	RE4LCDH-PNL
LCD OIM Cable for remote use	RECBL-LCD
LCD OIM Extender Cable (0.3 meter)	RECBL-F03
LCD OIM Extender Cable (1 meter)	RECBL-F10
LCD OIM Extender Cable (3 meters)	RECBL-F30
LCD OIM Extender Cable (9 meters)	RECBL-F90

Table 12.O Drive Unit

Description	Part Number
Controller Board for 1 through 20 HP 480V/1 through 10 HP 208V	179774
Controller Board for 25 HP and larger	313741-K01
24 V I/O Board (25 HP and larger)	195239 (M/N 9VT-024A)

Table 12.P Replacement Parts - Bypass Option

Description	Manufacturer[1] Part Number
Selector Switch, 3-position (Hand-Off-Auto)[2]	800EP-SM32
Selector Switch, 3-position (Drive-Test-Bypass)[3]	800EP-SM32C1
Mounting Latch, 3-Across	800E-A32
Contact Block, 1 N.C.	800E-3X01
Contact Block, 1 N.O.E.M.	800E-3x10E
Contact Block, 1 N.O.	800E-3X10
Bypass Control Interface Kit	RE1BPC (Rockwell Automation)

(1) Part numbers are listed for local sourcing. Most bypass circuit components are manufactured by Allen-Bradley and may be sourced from local authorized distributors.

(2) Requires quantity (2) N.O. Contact Blocks and quantity (1) N.O.E.M. Contact Block.

(3) Requires quantity (2) N.O. Contact Blocks and quantity (1) N.C. Contact Block.

Table 12.Q Replacement Parts - Style A

Description	HP	Part Number[1]
Disconnect Switch "DS" (fused)	1 to 5 @ 208V 1 to 10 @ 480V	194R-NJ030P3
	7.5 to 10 @ 208V 15 to 25 @ 480V	194R-NJ060P3
	30 to 50 @ 480V	194R-NJ100P3
	60 to 75 @ 480V	194R-NJ200P3
	125 to 150 @ 480V	194R-NJ400P3
Disconnect Switch (non-fused)	1 to 10 @ 208V 1 to 10 @ 480V	194R-NN030P3
	15 to 25 @ 480V	194R-NN060P3
	30 to 50 @ 480V	194R-NN100P3
	60 to 75 @ 480V	194R-NN200P3
	125 to 150 @ 480V	194R-NN400P3
Main Disconnect Handle	1 to 10 @ 208V 1 to 25 @ 480V	194R-HS1
	30 to 150 @ 480V	194R-HM1

[1] A-B part numbers except as noted.

Table 12.R Replacement Parts - Style B

Description	HP	Part Number[1]
Control Transformer (50V A)	1 to 10 @ 208V 1 to 20 @ 480V	Acme TA-2-69300
Control Transformer (100V A)	25 to 60 @ 480V	Acme TA-2-69301
	75 to 150 @ 480V	Acme TA-2-69302
Disconnect Switch "DS"	1 to 5 @ 208V 1 to 10 @ 480V	194R-NJ030P3
	7.5 to 10 @ 208V 15 to 25 @ 480V	194R-NJ060P3
	30 to 50 @ 480V	194R-NJ100P3
	60 to 75 @ 480V	194R-NJ200P3
	125 to 150 @ 480V	194R-NJ400P3
Main Disconnect (non-fused)	1 to 10 @ 208V 1 to 10 @ 480V	194R-NN030P3
	15 to 25 @ 480V	194R-NN060P3
	30 to 50 @ 480V	194R-NN100P3
	60 to 100 @ 480V	194R-NN200P3
	125 to 150 @ 480V	194R-NN400P3
Main Disconnect Handle	1 to 10 @ 208V 1 to 25 @ 480V	194R-HS1
	30 to 100 @ 480V	194R-HM1

Description	HP	Part Number[1]
Bypass Contactor “BC”	1 to 3 @ 208V 1 to 5 @ 480V	100-C16D10
	5 @ 208V 7.5 to 10 @ 480V	100-C23D10
	7.5 to 10 @ 208V 15 to 25 @ 480V	100-C37D00
	30 @ 480V	100-C43D00
	40 to 50 @ 480V	100-C72D00
	60 @ 480V	100-C85D00
	75 @ 480V	CAB6-105EI1110A
	100 @ 480V	CAB6-140EI1110A
	125 to 150 @ 480V	CAB6-170EI1110A
Overload Relay “OL”	1 @ 208V 1 to 2 @ 480V	193-EA2EB
	2 to 3 @ 208V 3 to 7.5 @ 480V	193-EA2FB
	5 @ 208V 10 @ 480V	193-EA2GB
	7.5 to 10 @ 208V 15 to 25 @ 480V	193-EA2HC
	30 @ 480V	193-EA2JD
	40 to 60 @ 480V	193-EA2KE
	75 to 150 @ 480V	193-A5M5
Drive Input Contactor “DIC”	1 to 10 @ 208V 1 to 20 @ 480V	100-C16D10
	25 to 30 @ 480V	100-C37D00
	40 @ 480V	100-C43D00
	50 to 60 @ 480V	100-C72D00
	75 @ 480V	100-C85D00
	100 to 125 @ 480V	CAB6-105EI1110A
	150 @ 480V	CAB6-140EI1110A
Drive Output Contactor “DOC”	1 to 7.5 @ 208V 1 to 20 @ 480V	100-C16D10
	10 @ 208V	100-C23D10
	25 to 30 @ 480V	100-C37D00
	40 @ 480V	100-C43D00
	50 to 60 @ 480V	100-C72D00
	75 @ 480V	100-C85D10
	100 @ 480V	CAB6-105EI1110A
	125 to 150@ 480V	CAB6-170EI1110A

[1] A-B part numbers except as noted.

Table 12.S Replacement Parts - Style M

Description	HP	Part Number[1]
Disconnect Switch “DS” Fused	60 to 75@ 480V	194R-NJ200P3
	100 @ 480V	194R-FCD1
Main Disconnect Handle	60 to 100 @ 480V	194R-HM1
Bypass Contactor “BC”	1 to 3 @ 208V	100-C16L10
	5 @ 208V	100-C23L10
	7.5 to 10 @ 208V	100-C37L10
	1 to 5 @ 480V	100-C16B10
	7.5 to10 @ 480V	100-C23B10
	15 to 20 @ 480V	100-C37B10
	60 @ 480V	100-C85B00
	75 @ 480V	CAB6-105EI1116
	100 @ 480V	CAB6-140EI1116
Motor Overload Relay “OL”	1 @ 208V 1 to 2 @ 480V	193-EA2EB
	2 to 3 @ 208V 3 to 7.5 @ 480V	193-EA2FB
	5 @ 208V 10 @ 480V	193-EA2GB
	7.5 to 10 @ 208V 15 to 25 @ 480V	193-EA2HC
	60 @ 480V	193-EA2KE
	75 to 100 @ 480V	193-A5M5
Drive Input Contactor “DIC”	1 to 10 @ 208V	100-C16L10
	1 to 20 @ 480V	100-C16B10
	60 @ 480V	100-C72B00
	75 @ 480V	100-C85B00
	100 @ 480V	CAB6-105EI1110A
Drive Output Contactor “DOC”	1 to 7.5 @ 208V	100-C16L10
	1 to 7.5 @ 208V	100-C23L10
	1 to 20 @ 480V	100-C16B10
	60 @ 480V	100-C72B00
	75 @ 480V	100-C85B00
	100 @ 480V	CAB6-105EI1110A

Description	HP	Part Number[1]
Motor Circuit Protector	1 @208V 3 @ 480V	140M-C2E-B63
	2 to 3 @ 208V 5 @ 480V	140M-D8E-C10
	5 @ 208V	140M-D8E-C20
	7.5 @ 208V 15 @ 480V	140M-D8E-C25
	10 @ 208V 20 @ 480B	140M-F8E-C32
	1 @ 480V	140M-C2E-B25
	2 @ 480V	140M-C2E-B40
	7.5 to 10 @ 480V	140M-D8E-C16
	25 @ 480V	140M-F8E-C45
	30 @ 480V	140-CMN-4000
	40 @ 480V	140-CMN-6300
	50 @ 480V	140-CMN-9000
Operator Handle	1 to 50 @ 480V	140M-CDN66

[1] A-B part numbers except as noted.

Troubleshooting the Drive Using the LCD OIM

The LCD OIM provides immediate visual notification of alarm or fault conditions as well as the following diagnostic information:

- Entries in the fault queue
- Fault parameters
- Drive status parameters
- Selected device version and status information
- OIM version information

Accessing the Fault Queue

As described on page 12-7, the drive automatically retains a history of the last four faults (eight in drive greater than 25 HP) that have occurred in the fault queue.

To access the fault queue, press the F4 key at the process display screen, or see Figure 12.5 to access the fault queue from the Main Menu.

Figure 12.5 Accessing the Fault Queue

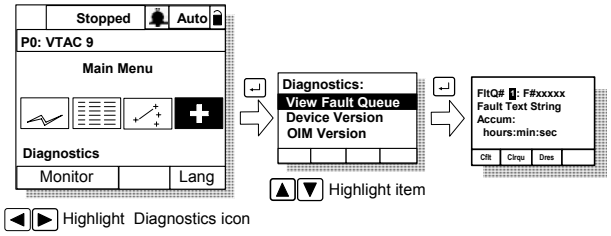
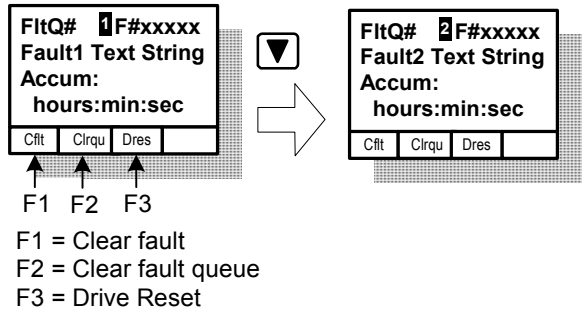


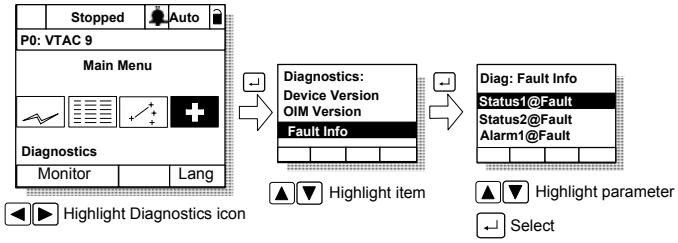
Figure 12.6 Sample Fault Queue Entry



Accessing the Fault Parameters

The LCD OIM provides quick access to the drive's fault parameters by grouping them in the Fault Info submenu. To access these parameters, see Figure 12.7.

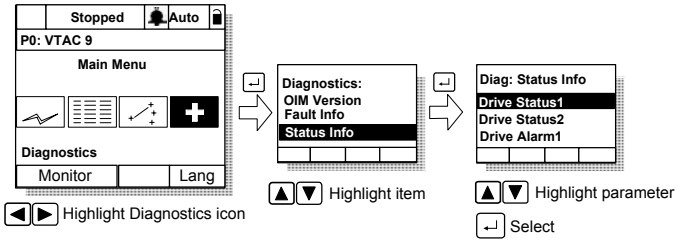
Figure 12.7 Accesing the Fault Parameters



Accessing the Drive Status Parameters

The LCD OIM provides quick access to the drive status parameters by grouping them in the Status Info submenu. To access these parameters, see Figure 12.8.

Figure 12.8 Accessing the Drive Status Parameters



Determining the Product Version

The LCD OIM provides hardware and firmware version information for connected devices, including the OIM, down to the component level.

Device Version

To access the device version information, refer to Figure 12.9 and Figure 12.10.

Figure 12.9 Accessing the Device Version Information

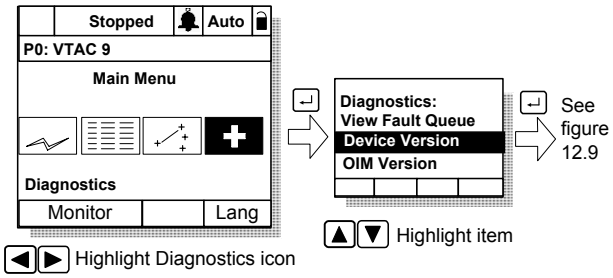
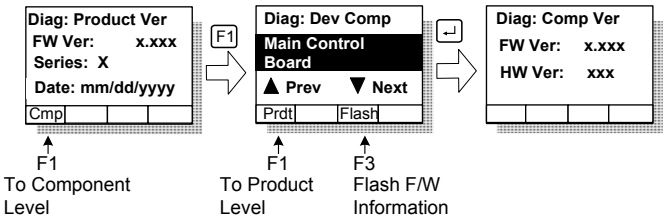


Figure 12.10 Device Version Screens at Product and Component Levels



OIM Version

The OIM Version selection provides information on the OIM you are using to access this data. See Figure 12.11 and Figure 12.12.

Figure 12.11 Accessing the OIM Version Information

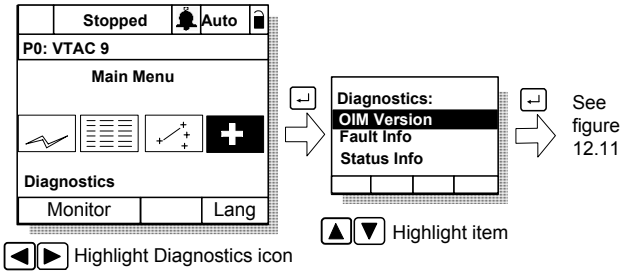
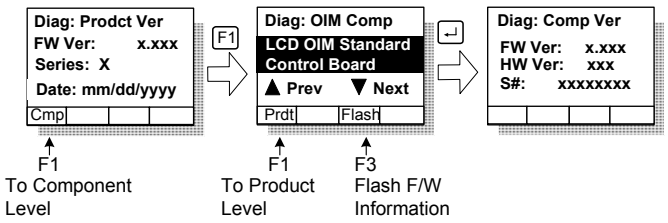


Figure 12.12 OIM Version Screens at the Product and Component Levels

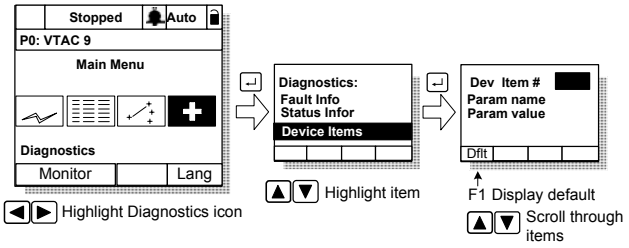


Device Items

The Device Items selection provides access to a list of diagnostic parameters. These parameters should be adjusted by qualified personnel only. See Figure 12.13.

ATTENTION: The parameters in the Device Items menu must be set by a qualified person who understands the significance of setting them accurately. Failure to observe this precaution could result in bodily injury.

Figure 12.13 Accessing the Device Item Information



Contacting Tech Support for Assistance

The Tech Support option in the Diagnostics menu provides information regarding technical support.

Technical Specifications

The specifications that follow apply only to the VTAC 9 drive unit, exclusive of any options.

Table A.A Protection

	208V Drive	**480V Drive**
AC Input Overvoltage Trip	247V AC	570V AC
AC Input Undervoltage Trip	120V AC	280V AC
Bus Overvoltage Trip	350 VDC	810 VDC
Bus Undervoltage Trip	160 VDC	300 VDC
Nominal Bus Voltage	281 VDC	648 VDC
All Drives		
Heat Sink Thermistor	Monitored by microprocessor overtemp trip	
Drive Overcurrent Trip Software Current Limit Hardware Current Limit Instantaneous Current Limit	 20-160% of rated current 200% of rated current (typical) 220-300% of rated current (dependent on drive rating)	
Line transients	up to 6000 volts peak per IEEE C62.41-1991	
Control Logic Noise Immunity	Showering arc transients up to 1500V peak	
Power Ride-Thru	15 milliseconds at full load	
Logic Control Ride-Thru	0.5 seconds minimum, 2 seconds typical	
Ground Fault Trip	Phase-to-ground on drive output	
Short Circuit Trip	Phase-to-phase on drive output	

Table A.B Applicable Standards

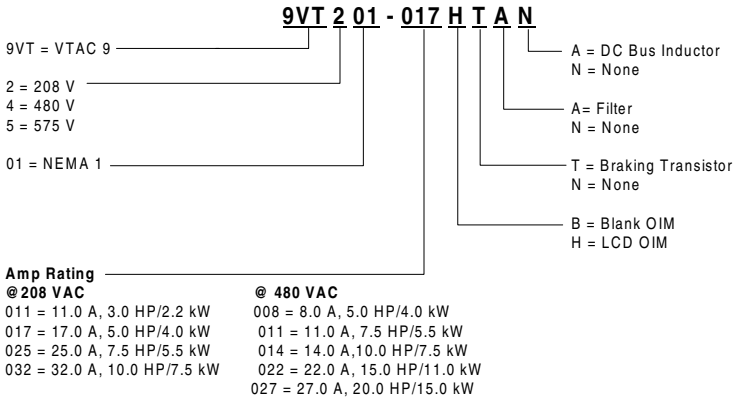
The drive is designed according to the following standards: NFPA 70 - US National Electrical Code NEMA ICS 7.1 - Safety standards for Construction and Guide for Selection, Installation and Operation of Adjustable Speed Drive Systems. NEMA 250 - Enclosures for Electrical Equipment

Table A.C Agency Certification

UL, cUL	UL and cUL Listed to UL508C and CAN/CSA-C22.2 No. 14-M91

FCC Compliance

VTAC9 208V and 480V units, including the model numbers represented below, comply with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.


9VT 2 01 - 017 H T A N
9VT = VTAC 9
2 = 208 V
4 = 480 V
5 = 575 V
01 = NEMA 1
A = DC Bus Inductor
N = None
A= Filter
N = None
T = Braking Transistor
N = None
B = Blank OIM
H = LCD OIM
Amp Rating
@208 VAC
011 = 11.0 A, 3.0 HP/2.2 kW
017 = 17.0 A, 5.0 HP/4.0 kW
025 = 25.0 A, 7.5 HP/5.5 kW
032 = 32.0 A, 10.0 HP/7.5 kW
@ 480 VAC
008 = 8.0 A, 5.0 HP/4.0 kW
011 = 11.0 A, 7.5 HP/5.5 kW
014 = 14.0 A,10.0 HP/7.5 kW
022 = 22.0 A, 15.0 HP/11.0 kW
027 = 27.0 A, 20.0 HP/15.0 kW

The models listed above have been verified by Rockwell Automation to be capable of complying with FCC Part 15, Subpart B, Section 15.107 and Section 15.109 for Class A digital devices when applied under the following conditions:

1. Input power conductors must pass though a Fair-Rite Products Corp. ferrite core part number 2643102002 or equivalent at the point they terminate at the input power terminal block inside the VTAC 9 cabinet.
2. Shielded motor cable must be used between the Output Power Terminal Block of the VTAC 9 unit and the motor, and the shield must be properly terminated to earth at each end.
3. No unauthorized modifications are made to the unit.

Responsible Party: Rockwell Automation

6400 W. Enterprise Drive

Mequon, Wisconsin 53092

262.512.8200

Table A.D Environment

Altitude	1000 m (3300 ft) max. without derating
Ambient Operating Temperature without derating: Open Type: NEMA Type 1	 0 to 50° C (32 to 122° F) 0 to 40° C (32 to 104° F)[1])
Storage Temperature (all const.)	–40 to 70° C (–40° to 158° F)
Relative Humidity	5 to 95% non-condensing
Shock	15 G peak for 11ms duration (±1.0 ms)
Vibration	0.152 mm (0.006 in.) displacement, 1 G peak

[1] To operate the drive between 40° C to 50° C (105°F to 122°F) ambient, remove the adhesive label fixed to the top of the drive enclosure.

Important: Removing the adhesive label from the drive changes the enclosure rating from Type 1 Enclosed to Open Type.

Voltage Tolerance	–10% of minimum, +10% of maximum.
Frequency Tolerance	47-63 Hz
Input Phases	Three-phase input provides full rating for all drives. Single-phase operation provides 50% of rated current.
Displacement Power Factor	0.98 lagging across all speed ranges
Efficiency	97.5% at rated amps, nominal line volts.
Max. Short Circuit Current Rating Using Recommended Fuse or Circuit Breaker Type	Maximum short circuit current rating to match specified fuse/circuit breaker capability.

Table A.E Control

Method	Sine coded PWM with programmable carrier frequency. Ratings apply to all drives . The drive can be supplied as 6-pulse or 12-pulse in a configured package.
Carrier Frequency	2-10 kHz. Drive rating based on 4 kHz.
Output Voltage Range	0 to rated motor voltage
Output Frequency Range	0 to 400 Hz.
Frequency Accuracy Digital Input Analog Input	 Within ±0.01% of set output frequency. Within ±0.4% of maximum output frequency.
Speed Regulation Open loop with slip compensation	±0.5% of base speed across 40:1 speed range.
Selectable Motor Control	Standard V/Hz with full custom capability.
Stop Modes	Multiple programmable stop modes including Ramp, Coast, DC-Brake, Ramp-to-Hold and S-curve.
Accel/Decel	Two independently programmable accel and decel times. Each time may be programmed from 0 to 3600 seconds in 0.1 second increments.
Intermittent Overload	110% overload capability for up to 1 minute. 150% overload capability for up to 3 seconds.
Current Limit Capability	Proactive Current Limit programmable from 20 to 160% of rated output current. Independently programmable proportional and integral gain.
Electronic Motor Overload Protection	Class 10 protection with speed sensitive response. Investigated by U.L. to comply with N.E.C. Article 430. U.L. File E59272, volume 12.

Table A.F :Control Inputs, Outputs, and Power Supplies

Analog Input 1, Differential Voltage Input	
Signal level	0 to +10 V
Differential Input resistance	60 kΩ
Isolation	±17 V
Initial accuracy (@25°C)	±0.3%
Resolution	10 bits (0.1%)
Input processing period	5 ms
Terminal block size	0.05 mm^2 to 1.5 mm^2 (30 AWG to 16 AWG)
Protection	ESD protected (6 kV contact discharge, 8 kV air discharge
Analog Input 1, Differential Current Input	
Signal level	0(4) to 20 mA
Differential Input resistance	100 Ω
Isolation	±9 V
Initial accuracy (@25°C)	±0.3%
Resolution	10 bits (0.1%)
Input processing period	5 ms
Terminal block size	0.05 mm^2 to 1.5 mm^2 (30 AWG to 16 AWG)
Protection	ESD protected (6 kV contact discharge, 8 kV air discharge
Analog Input 2, Differential Voltage Input	
Signal level	-10 V to +10 V
Differential Input resistance	88 kΩ
Isolation	±165 V
Initial accuracy (@25°C)	±0.3%
Resolution	10 bits (0.1%)
Common Mode Rejection Ratio	70 dB up to 500 Hz over temperature range
Input processing period	5 ms
Terminal block size	0.05 mm^2 to 1.5 mm^2 (30 AWG to 16 AWG)
Protection	ESD protected (6 kV contact discharge, 8 kV air discharge
Analog Input 2, Differential Current Input	
Signal level	0 (4)-20mA
Differential Input resistance	100 Ω
Isolation	±165 V
Initial accuracy (@25°C)	±0.3%
Resolution	10 bits (0.1%)
Common Mode Rejection Ratio	70 dB up to 500Hz over temp range
Input processing period	5 ms
Terminal block size	0.05 mm^2 to 1.5 mm^2 (30 AWG to 16 AWG)
Protection	ESD protected (6 kV contact discharge, 8 kV air discharge
Analog Output (25 HP and larger)	
Voltage	0 to +10 V
Analog output voltage range	2 kΩ minimum
Loading impedance	±2.35% maximum
Accuracy over temperature range	10 bits (0.1%)
Resolution	160 Hz maximum
Frequency of output waveform	5 ms
Output processing period	0.05 mm^2 to 1.5 mm^2 (30 AWG to
Terminal block size	16 AWG)
Protection	Short circuit proof, ESD protected (6 kV contact discharge, 8 kV air discharge
Current	
Analog output current range	4 to 20 mA
Accuracy	11 bits (+ sign)
Maximum Load	400Ω

Reference Power Supply	
Output Voltage	10 V
Potentiometer resistance range	2 kΩ to 10kΩ
Accuracy over temperature range	±2.35% maximum
Terminal block size	0.05 mm^2 to 1.5 mm^2 (30 AWG to 16 AWG)
Protection	Short circuit proof, ESD protected (6 kV contact discharge, 8 kV air discharge
Internal 24V Power Supply (not be used to power external devices)	
Output Voltage	24 V to 28V
Output Current	300 mA maximum
Isolation	±25 V
Terminal block size	0.05 mm^2 to 1.5 mm^2 (30 AWG to 16 AWG)
Protection	Short circuit proof, ESD protected (6 kV contact discharge, 8 kV air discharge
Six Digital Inputs	
Input voltage	24V (nominal)
Logic thresholds	logic 0: V_{in} < 5V; logic 1: V_{in} > 8V
Input resistance	2 kΩ
Isolation	± 25V
Assertion response (hardware only)	9 ms maximum
Negation response (hardware only)	1 ms maximum
Terminal block size	0.05 mm^2 to 1.5 mm^2 (30 AWG to 16 AWG)
Protection	Short circuit proof, ESD protected (6 kV contact discharge, 8 kV air discharge
Two Form C Relay Outputs	
Maximum Contact Voltage	250V AC, 220 VDC
Contact rating for resistive loads	0.40 A at 125V AC, 2 A at 30 VDC
Contact switching for resistive loads	50 VA, 60 W
Contact rating for inductive loads	0.20 A at 125V AC, 1 A at 30 VDC
Contact switching for inductive loads	25 VA, 30 W
Isolation test voltage	1900 VDC for one minute
Terminal block size	0.05 mm^2 to 1.5 mm^2 (30 AWG to 16 AWG)
Protection	Short circuit proof, ESD protected (6 kV contact discharge, 8 kV air discharge

Figure A.1 Derating Guidelines - Altitude

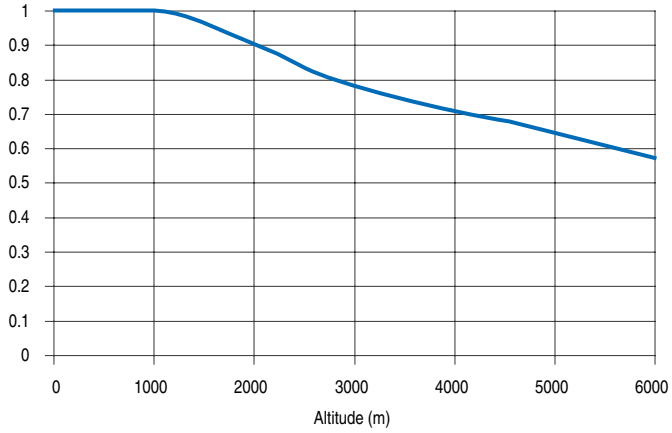


Table A.G Derating Guidelines - HP

No Derate Required for:	
HP	**Max. Carrier Freq.**
1 to 5	2 to 10 kHz
7.5 to 10	2 to 8 kHz
20	2 to 6 kHz
25	2 to 4 kHz
30	2 to 10 kHz
40	2 to 4 kHz
50	2 to 4 kHz
60 to 75	2 to 8 kHz
100	2 to 4 kHz

Figure A.2 Derating Curve - 20 HP

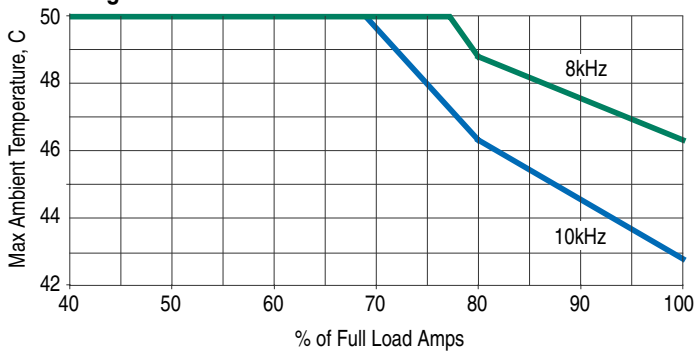


Figure A.3 Derating Curve - 25 HP

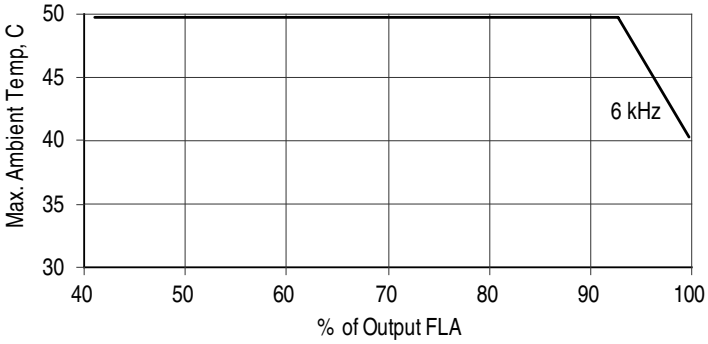


Figure A.4 Derating Curve - 40 HP

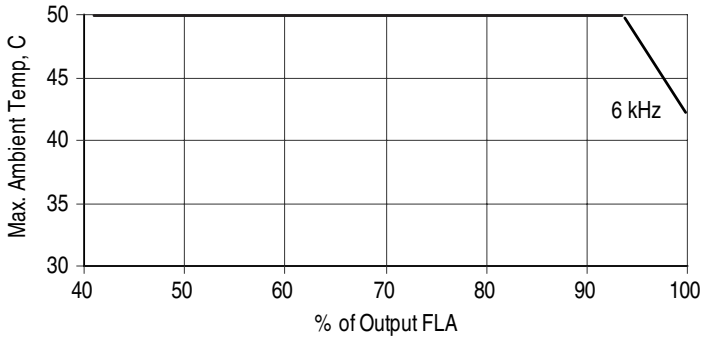


Figure A.5 Derating Curve - 50 HP

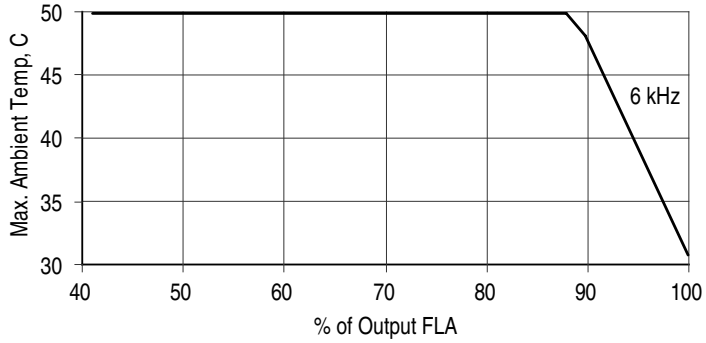
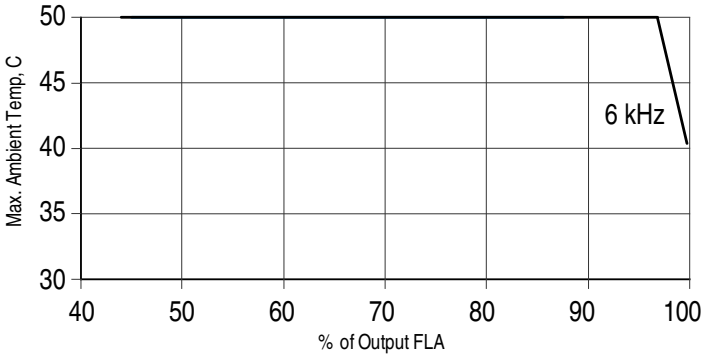


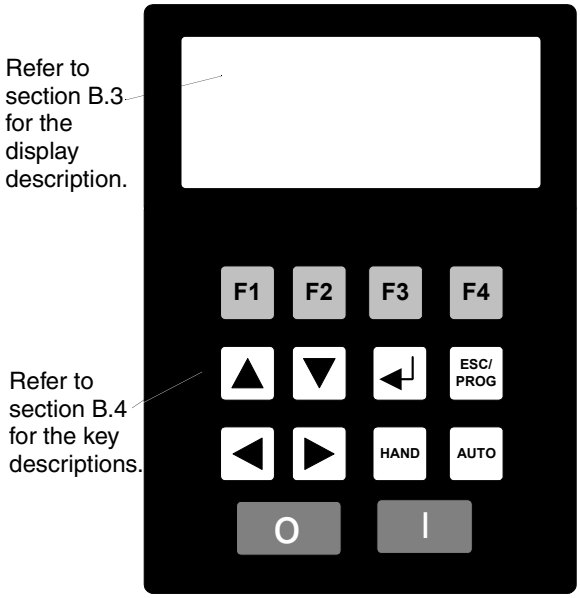
Figure A.6 Derating Curve - 100 HP



Using the LCD OIM

The LCD Operator Interface Module (OIM) is a keypad/display that enables you to program, monitor, and control the drive.

Figure B.1 VTAC 9 LCD OIM



Connections

The LCD OIM can be used in the following ways:

Drive mounted - The OIM connects directly to the drive using DPI port 1.

Hand-held - A cable (RECBL-LCD) must be used to convert the OIM for hand-held use. The maximum cable length is 32 feet using extender cables. Connect the cable to either DPI port 2 or 3.

Remote mounted - A cable (RECBL-LCD) must be used to convert the OIM for remote-mounted use. The maximum cable length is 32 feet using extender cables. Connect the cable to either DPI port 2 or 3.

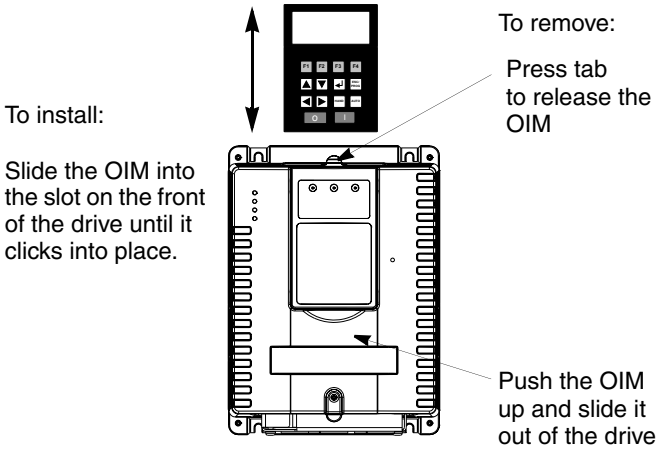
See figureTable 2.3 on page 10in chapter 2 for the connection points on the drive.

Installing and Removing the Local LCD OIM

To **install** the local LCD OIM, slide the OIM into the slot on the front of the drive until it clicks into place.

To **remove** the local LCD OIM, press the tab at the top of the drive to release the OIM while pushing the OIM from the bottom to slide it out of the drive.

Figure B.2 Installing and Removing the Local LCD OIM


To remove:
Press tab to release the OIM
To install:
Slide the OIM into the slot on the front of the drive until it clicks into place.
Push the OIM up and slide it out of the drive

Removing the Local LCD OIM While the Drive is Powered

If the local LCD OIM is the selected control source, removing the OIM while the drive is powered will cause a drive fault.

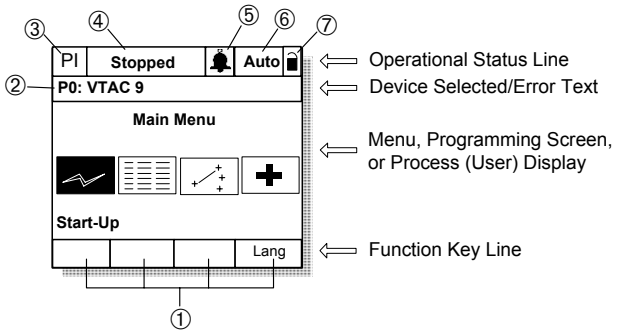
If the local LCD OIM is not the selected control source, but is the reference source, removing the OIM while the drive is powered will result in a zero reference value. When the OIM is replaced, the drive will ramp to the reference level supplied by the OIM.

ATTENTION: Removing and replacing the LCD OIM while the drive is running may cause an abrupt speed change if the LCD OIM is the selected reference source, but is not the selected control source. The drive will ramp to the reference level provided by the OIM at the rate specified in Accel Time 1 (140), Accel Time 2 (141), Decel Time 1 (142) and Decel Time 2 (143). Be aware that an abrupt speed change may occur depending upon the new reference level and the rate specified in these parameters. Failure to observe this precaution could result in bodily injury.

If the local LCD OIM is not the selected control source or reference source, removing the OIM while the drive is powered will have no effect on drive operation.

Display Description

Figure B.3 The Display (Main Menu Shown)



①	Function Key (F1, F2, F3, F4) definitions
②	Port/peripheral identification. Identifies port or peripheral on DPI about which the OIM is displaying information. See section Section .
③	PI loop status: PI = PI control is active.
④	Operating status (for example, Running, Stopped, etc.)
⑤	Alarm annunciation. = Alarm has occurred.
⑥	Auto/Hand mode status.
⑦	Write-protect password status: (unlocked) = password disabled; (locked) = password enabled. See section Section 10.4

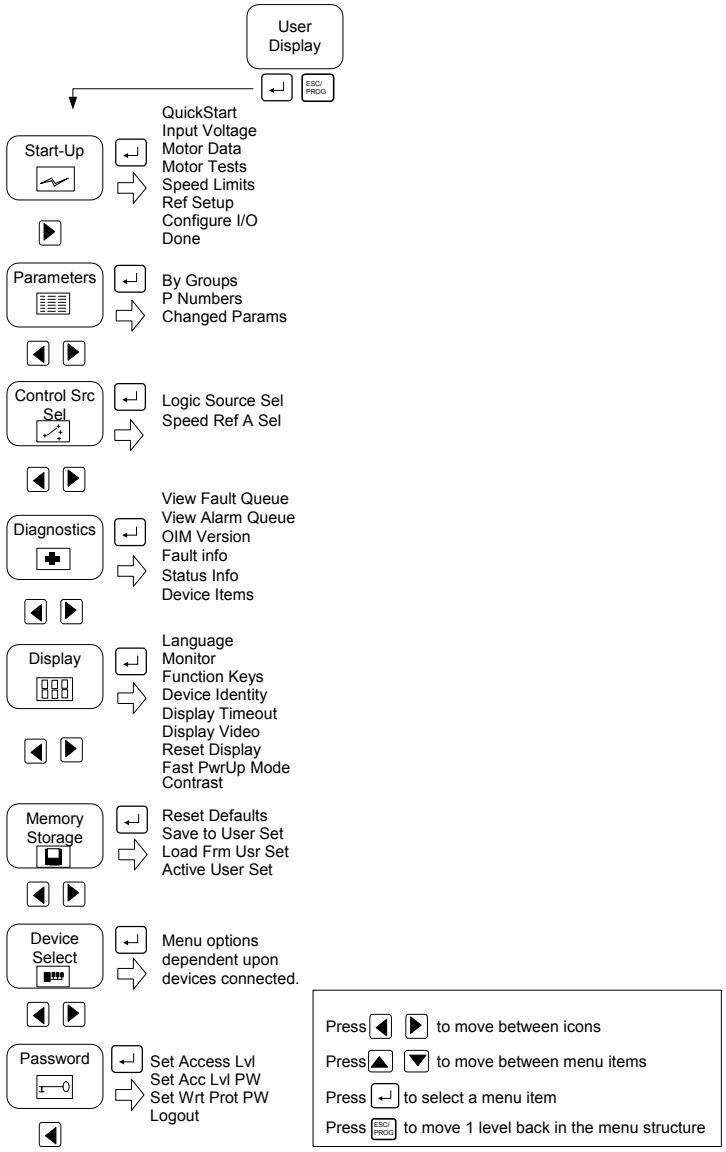
Key Descriptions

Key	Function
◀	Scroll through options or user function keys, move cursor to the left.
▶	Scroll through options or user functions keys, move cursor to the right.
▲	Scroll through options, increase a value, or toggle a bit.
▼	Scroll through options, decrease a value, or toggle a bit.
ESC/ PROG	Exit a menu, cancel a change to a parameter, or toggle between program and process (user) display screens.
↵	Enter a menu, select an option, or save changes to parameter value
HAND	Enable Hand (manual) reference control.
AUTO	Release Hand (manual) reference control.
○	Stop the drive. Clear a fault if the OIM is the control source.
|	Start the drive if the OIM is the control source.
F1	F1 though F4: Predefined or user-configured functions. The definition of each key is shown directly above the key on the display. See item ① in figure Figure B.3.

ATTENTION: When switching from Auto to Hand, or Hand to Auto, the drive will ramp to the reference level provided by the new source at the rate specified in Accel Time 1 (140), Decel Time 1 (142), Accel Time 2 (141), or Decel Time 2 (143). Be aware that an abrupt speed change may occur depending upon the new reference level and rate specified in these parameters. Failure to observe this precaution could result in bodily injury.

LCD OIM Menu Structure

LCD OIM Menu Structure



Powering Up and Adjusting the LCD OIM

The first time the LCD OIM is powered up, you will be prompted to select a language for the display text. If the Start-Up routine has not been completed, the Start-Up menu is displayed immediately following the language selection screen.

On subsequent power ups, if both of these requirements have been met, the Main Menu is displayed after the initialization screen.

Selecting the Fast Power Up Feature

The fast power up feature bypasses the initialization screen at power up, and the Main Menu is displayed immediately. To select this feature, select Fast PwrUp Mode from the Display menu.

Adjusting the Screen Contrast

To adjust the screen contrast, select Contrast from the Display menu.

Resetting the Display

To return all the options for the display to factory-default values, select Reset Display from the Display menu.

Selecting a Device in the System

The LCD OIM can access and display data from any active drive or peripheral device on the network. The drive (port 0) is the default device selected.

To select a device, select the Device Select icon from the Main Menu. The options listed depend on what is connected to the network.

The name and DPI port number of the device being accessed is shown on the OIM's display.

Using the LCD OIM to Program the Drive

The LCD OIM enables you to view and adjust parameters in the drive or in peripheral devices connected to the drive. The parameters available for viewing or adjustment depend on the device selected. See section Figure for information about selecting a device.

The method of viewing and adjusting parameters is the same regardless of the device selected.

Viewing and Adjusting Parameters

Refer to chapter 10 for information on how to access the parameters in the drive.

Each parameter screen contains the following information:

- Parameter number
- Parameter name
- Current parameter value and units
- Parameter range
- **F1 key defined as a toggle to enable you to view the parameter's current value and the factory-default value**

See Figure B.4 and Table B.A on page B-7 for instructions on how to adjust the parameter values.

Figure B.4 Adjusting Parameters

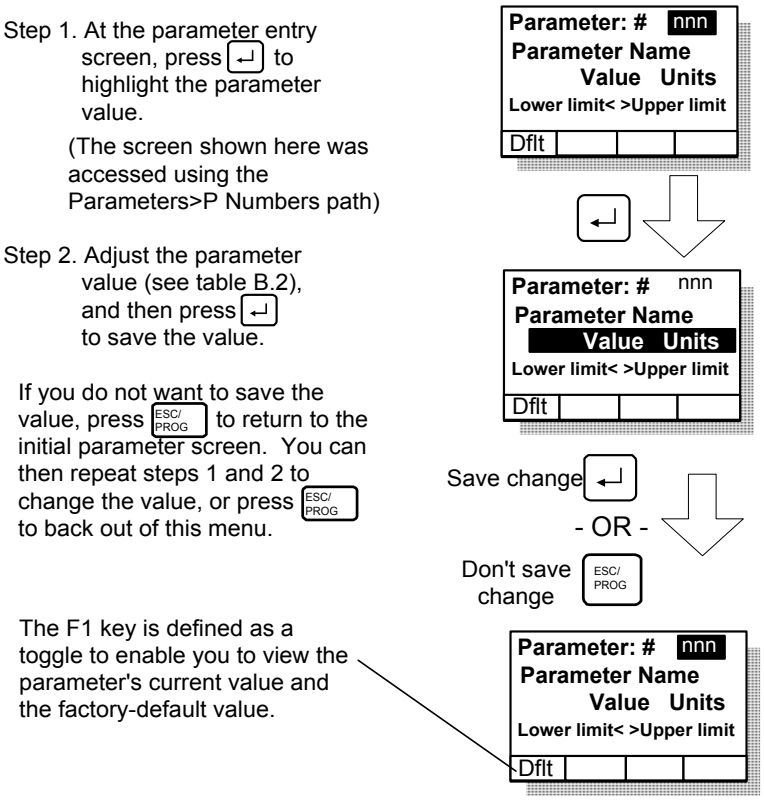

Step 1. At the parameter entry screen, press ↵ to highlight the parameter value.
(The screen shown here was accessed using the Parameters>P Numbers path)
Step 2. Adjust the parameter value (see table B.2), and then press ↵ to save the value.
If you do not want to save the value, press ESC/PROG to return to the initial parameter screen. You can then repeat steps 1 and 2 to change the value, or press ESC/PROG to back out of this menu.
The F1 key is defined as a toggle to enable you to view the parameter's current value and the factory-default value.
Parameter: # nnn
Parameter Name
Value Units
Lower limit< >Upper limit
Dflt
Save change ↵
- OR -
Don't save change ESC/PROG

Table B.A How to Adjust Each Parameter Type

Parameter Type	How to Adjust
Numbered List	Use up/down arrow keys to advance through the list of options.
Bit	Use ◀ ▶ to move the cursor to the bit location you want to change. Use ▲ ▼ to change the value of the bit.
Numeric	Use ▲ ▼ to increase or decrease the value. - Or - Use ◀ ▶ to move the cursor from digit to digit, and use ▲ ▼ to increase or decrease the value of the digit.

To restore all parameters to their factory-default values, select Reset Defaults from the Memory Storage menu.

Note that the parameter values are retained through a line dip or power shutdown.

Loading and Saving User Sets

Drive configurations, called user sets, can be saved and recalled for use at any time. Up to three user sets can be saved in the VTAC 9 drive.

To **save** the current drive configuration, select Save to User Set from the Memory Storage menu.

To recall, or **load**, a user set, select Load Frm Usr Set from the Memory Storage menu.

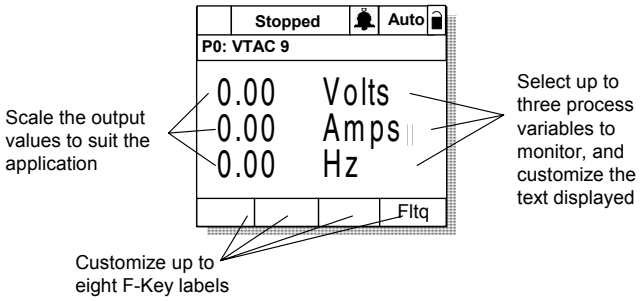
To **identify** which user set is active, select Active User Set from the Memory Storage menu. The name of the last user set to be loaded into the drive will be displayed. “Active Set” means factory defaults have been restored.

Monitoring the Drive Using the Process Display Screen on the LCD OIM

The process display screen enables you to monitor up to three process variables (six on frames 2 and 3. Use a function key programmed as Next to toggle bwtween the process display variables). You can select the display, parameter, scale, and text for each process variable being displayed.

The ESC/PROG key toggles between the programming screen and the process display screen. From the Main Menu screen, press F1 or F2 to select the process display screen. In addition, the process display screen becomes active if no keys have been pressed before the display timeout period expires. See section Table , “Setting the Display Timeout Period”, on page -10 for information about setting the display timeout period.

Process (User) Display Screen

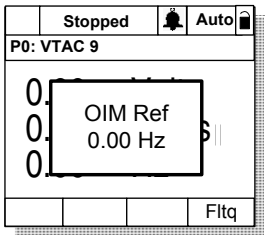


Displaying and Changing the OIM Reference

You can display the reference value that the OIM is sending to the drive by pressing the up or down arrow key once when the process display screen is active. See Figure B.5. The OIM reference can be used for the speed reference, PI reference, or trim reference.

To change the displayed reference, press and hold down either the up or down arrow key until the desired value is displayed. Release the key to return to the process display screen.

Figure B.5 OIM Reference Displayed



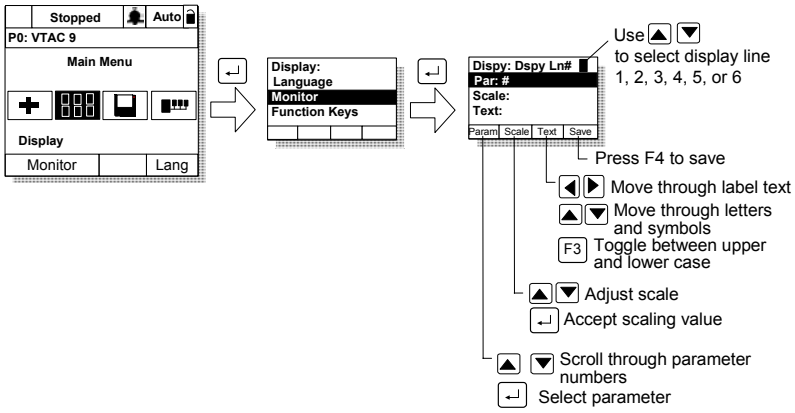
Note that changing the value of the OIM reference does not affect the value of any other port reference.

The value of the OIM reference is saved through a power cycle if parameter 192 (Save OIM Ref) is set to save at power down.

Customizing the Process Display Screen

To customize the process display screen, select Monitor from the Display menu. See Figure B.6.

Figure B.6 Customizing the Process Display Screen



Customizing the Function Keys

The function keys (F1, F2, F3, and F4, also called F-Keys) on the OIM can be customized to perform several pre-configured functions when the process display screen is active.

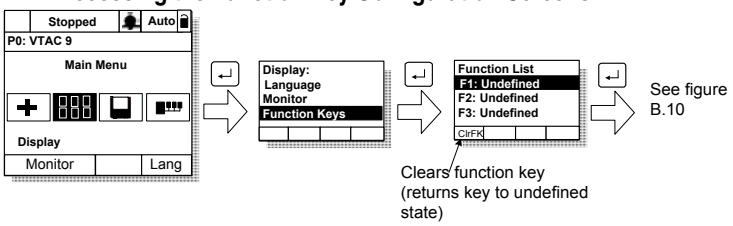
Up to eight function keys can be configured. Pressing ◀ ▶ while the display screen is active toggles between each set of four functions.

As shipped from the factory, the F4 key is configured for the Clear Fault Queue function.

To assign a function to an F-Key, select the Display icon from the Main Menu as shown in Figure B.7 and Figure B.8.

The F-Key definitions are the same for all OIMs connected to the drive, regardless of the port used.

Figure B.7 Accessing the Function Key Configuration Screens



Select from the list of preconfigured functions:

Undefined (default)

Load User Set 1-3: Loads the specified user set into active drive memory. The drive responds as if a value had been entered in Load Frm User Set (198), or Load Frm Usr Set was selected from the OIM's Memory Storage menu.

ATTENTION: Loading a user set with LevelSense Start (168) set to Enable can result in the drive starting immediately when all start conditions are met.

When this function is enabled, the user must ensure that automatic start up of the driven equipment will not cause injury to operating personnel or damage to the driven equipment. In addition, the user is responsible for providing suitable audible or visual alarms or other devices to indicate that this function is enabled and the drive may start at any moment. Failure to observe this precaution could result in severe bodily injury or loss of life.

Save User Set 1-3: Saves the active configuration to drive memory. The drive responds as if a value had been entered in Save to User Set (199) or Save to User Set was selected from the OIM's Memory Storage menu.

Acc/Dec Change: Toggles between the display of Acc/Dec rate 1 and Acc/Dec rate 2 (The value the drive is configured to go to, not the current value being used by the drive). This selection is based on the active value of the rate parameters (140-143). Therefore, when any of these parameters change, the actual acc/dec rates will dynamically change.

Preset Speed 1-6: Toggles the selected preset speed on and off and grants Hand (manual) reference control. Returns to Auto reference when the function is toggled.

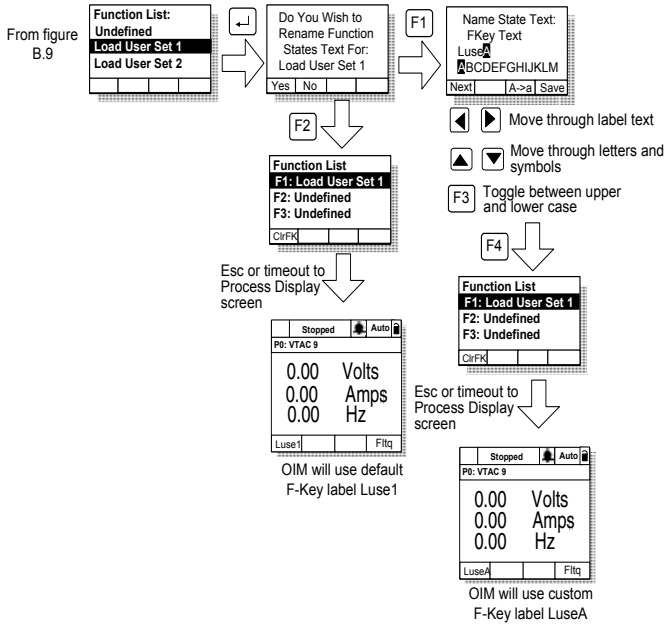
View Fault Queue: Displays the Fault Queue screen (see Chapter 12). Press ESC/PROG to return to the process display screen.

Next: (Frames 2 and 3 only) Togle to net set of three process display variables.

Customizing the Function Key Label Text

You can customize the text for each function key label (up to five characters). See Figure B.8.

Figure B.8 Customizing the Function Key Label Text



Setting the Display Timeout Period

When the OIM is inactive (that is, no keys have been pressed) for a user-specified period of time, the process display screen becomes active. To return to the previously active screen, press any key. To return to the Main Menu, press ESC/PROG.

To set the display timeout period, select Display Timeout from the Display menu. The timeout period can range from 10 to 1200 seconds (20 minutes).

This feature can also be disabled by pressing the F1 key while in the display time screen.

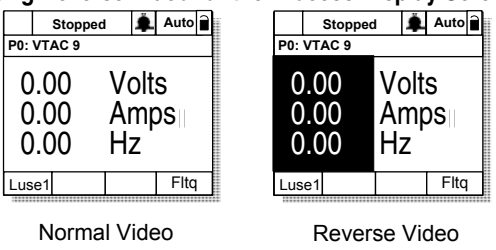
Note that each OIM connected to the drive can have a different timeout period.

Using Reverse Video for the Process Display Screen

To select normal or reverse video for the process display screen, select Display Video from the Display menu. See figure Figure B.9 for sample screens.

Note that each OIM connected to the drive can have a different display mode.

Figure B.9 Selecting Reverse Video for the Process Display Screen



Controlling the Drive From the LCD OIM

When the OIM is the selected control source, it can be used to control the drive:

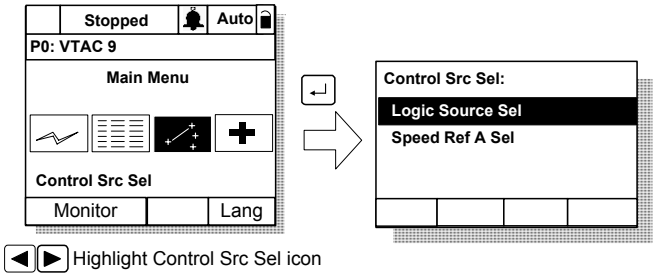
- Start (Run)
- Stop
- Clear Faults

Selecting the Logic and Reference Source

Parameters 89 [Logic Source Sel] and 90 [Ref Source Sel]

are used to select the drive control and speed reference sources. These parameters are grouped in the Control Src Select menu. See Figure B.10.

Figure B.10 Selecting the Control and Reference Source



ATTENTION: Removing and replacing the LCD OIM while the drive is running may cause an abrupt speed change if the LCD OIM is the selected reference source, but is not the selected control source. The drive will ramp to the reference level provided by the OIM at the rate specified in [Accel Time 1] (140), [Accel Time 2] (141), [Decel Time 1] (142) and [Decel Time 2] (143). Be aware that an abrupt speed change may occur depending upon the new reference level and the rate specified in these parameters. Failure to observe this precaution could result in bodily injury.

Both of these parameters can also be accessed individually through the Parameters menu.

Refer to Chapter 12 for a description of the parameters.

Starting the Drive

When the OIM is the selected control source, pressing [I] issues a start command to the drive.

Stopping the Drive

Pressing [O] will issue a stop command to the drive.

Important: Stop commands from any attached OIM will always be enabled.

Parameters in the Standard Access Level

The following parameters are accessible when the Standard access level (1) is selected.

Note that *all* parameters are accessible when the Advanced access level (2) is selected.

No.	Parameter Name	Path (File>Group)	Page No.
1	Output Freq	Monitor>Metering	2
2	Commanded Freq	Monitor>Metering	2
3	Output Current	Monitor>Metering	2
6	Output Voltage	Monitor>Metering	3
7	Output Power	Monitor>Metering	3
9	Elapsed MWh	Monitor>Metering	3
10	Elapsed Run Time	Monitor>Metering	4
11	MOP Frequency	Monitor>Metering	4
12	DC Bus Voltage	Monitor>Metering	4
16	Analog In1 Value	Monitor>Metering	5
26	Rated kW	Monitor>Drive Data	5
27	Rated Volts	Monitor>Drive Data	5
28	Rated Amps	Monitor>Drive Data	5
29	Control SW Ver	Monitor>Drive Data	6
41	Motor NP Volts	Motor Control>Motor Data	6
42	Motor NP FLA	Motor Control>Motor Data	6
43	Motor NP Hertz	Motor Control>Motor Data	7
44	Motor NP RPM	Motor Control>Motor Data	7
45	Motor NP Power	Motor Control>Motor Data	8
46	Mtr NP Pwr Units	Motor Control>Motor Data	8
54	Maximum Voltage	Motor Control>Torq Attributes	11
55	Maximum Freq	Motor Control>Torq Attributes	11
70	Run Boost	Motor Control>Volts per Hertz	16
80	Speed Mode	Speed Command>Spd Mode & Limits	17
81	Minimum Speed	Speed Command>Spd Mode & Limits	17
82	Maximum Speed	Speed Command>Spd Mode & Limits	18
84	Skip Frequency 1	Speed Command>Spd Mode & Limits	19
89	Logic Source Sel	Speed Command>Control Src Select	19
90	Speed Ref A Sel	Speed Command>Control Src Select Speed Command>Speed References	21
91	Speed Ref A Hi	Speed Command>Speed References	22
92	Speed Ref A Lo	Speed Command>Speed References	22
107	Purge Speed	Speed Command>Discrete Speeds	23
140	Accel Time 1	Dynamic Control>Ramp Rates	33
142	Decel Time 1	Dynamic Control>Ramp Rates	34
146	S Curve %	Dynamic Control>Ramp Rates	34
148	Current Lmt Val	Dynamic Control>Load Limits	34

No.	Parameter Name	Path (File>Group)	Page No.
150	Drive OL Mode	Dynamic Control>Load Limits	35
151	CarrierFrequency	Dynamic Control>Load Limits	35
155	Stop Mode A	Dynamic Control>Stop/Brake Modes	36
168	LevelSense Start	Dynamic Control>Stop/Restart Modes	40
174	Auto Rstrt Tries	Dynamic Control>Stop/Restart Modes	42
175	Auto Rstrt Delay	Dynamic Control>Stop/Restart Modes	43
196	Param Access Lvl	Utility>Drive Memory	50
197	Reset To Defalts	Utility>Drive Memory	50
200	Reset Meters	Utility>Drive Memory	51
320	Anlg In Config	Inputs & Outputs>Analog Inputs	71
321	Anlg In Sqr Root	Inputs & Outputs>Analog Inputs	71
322	Analog In 1 Hi	Inputs & Outputs>Analog Inputs	72
323	Analog In 1 Lo	Inputs & Outputs>Analog Inputs	73
324	Analog In 1 Loss	Inputs & Outputs>Analog Inputs	73
340	Anlg Out Config	Inputs & Outputs>Analog Outputs	11-68
342	Analog Out1 Sel	Inputs & Outputs>Analog Outputs	76
343	Analog Out1 Hi	Inputs & Outputs>Analog Outputs	76
344	Analog Out1 Lo	Inputs & Outputs>Analog Outputs	77
380	Digital Out1 Sel	Inputs & Outputs>Digital Outputs	85
381	Dig Out1 Level	Inputs & Outputs>Digital Outputs	86
384	Digital Out2 Sel	Inputs & Outputs>Digital Outputs	87
385	Dig Out2 Level	Inputs & Outputs>Digital Outputs	88

Parameters Cross-Referenced by Name

Parameter Name	No.	Path (File>Group)	Page No.
Accel Time 1	140	Dynamic Control>Ramp Rates	33
Accel Time 2	141	Dynamic Control>Ramp Rates	33
Alarm 1 @ Fault	229	Utility>Diagnostics	61
Alarm 2 @ Fault	230	Utility>Diagnostics	61
Alarm Config 1	259	Utility>Alarms	64
Analog In 1 Hi	322	Inputs & Outputs>Analog Inputs	72
Analog In 1 Lo	323	Inputs & Outputs>Analog Inputs	73
Analog In 1 Loss	324	Inputs & Outputs>Analog Inputs	73
Analog In 2 Hi	325	Inputs & Outputs>Analog Inputs	74
Analog In 2 Lo	326	Inputs & Outputs>Analog Inputs	74
Analog In 2 Loss	327	Inputs & Outputs>Analog Inputs	74
Analog In1 Value	16	Monitor>Metering	5
Analog In2 Value	17	Monitor>Metering	5
Analog Out1 Hi	343	Inputs & Outputs>Analog Outputs	76
Analog Out1 Lo	344	Inputs & Outputs>Analog Outputs	77
Analog Out1 Sel	342	Inputs & Outputs>Analog Outputs	76
Anlg In Config	320	Inputs & Outputs>Analog Inputs	71
Anlg In Sqr Root	321	Inputs & Outputs>Analog Inputs	71
Anlg Out Absolute	341	Inputs & Outputs>Analog Outputs	75
Anlg Out Config	340	Inputs & Outputs>Analog Outputs	11-68
Auto Rstrt Delay	175	Dynamic Control>Stop/Restart Modes	43
Auto Rstrt Tries	174	Dynamic Control>Stop/Restart Modes	42
Autotune	61	Motor Control>Torq Attributes	14
Break Frequency	72	Motor Control>Volts per Hertz	16
Break Voltage	71	Motor Control>Volts per Hertz	16
Bus Reg Gain	160	Dynamic Control>Stop/Brake Modes	37
Bus Reg Kd	165	Dynamic Control>Stop/Brake Modes	11-34
Bus Reg Ki	160	Dynamic Control>Stop/Brake Modes	11-32
Bus Reg Kp	164	Dynamic Control>Stop/Brake Modes	11-34
Bus Reg Mode A	161	Dynamic Control>Stop/Brake Modes	38
Bus Reg Mode B	162	Dynamic Control>Stop/Brake Modes	38
CarrierFrequency	151	Dynamic Control>Load Limits	35
Commanded Freq	2	Monitor>Metering	2
Compensation	56	Motor Control>Torq Attributes	12
Control SW Ver	29	Monitor>Drive Data	6
Current Lmt Gain	149	Dynamic Control>Load Limits	35
Current Lmt Sel	147	Dynamic Control>Ramp Rates	34
Current Lmt Val	148	Dynamic Control>Load Limits	34
Data In A1 - Link A Word 1	300	Communication>Datalinks	68

Parameter Name	No.	Path (File>Group)	Page No.
Data In A2 - Link A Word 2	301	Communication>Datalinks	68
Data In B1 - Link B Word 1	302	Communication>Datalinks	68
Data In B2 - Link B Word 2	303	Communication>Datalinks	68
Data In C1 - Link C Word 1	304	Communication>Datalinks	69
Data In C2 - Link C Word 2	305	Communication>Datalinks	69
Data In D1 - Link D Word 1	306	Communication>Datalinks	69
Data In D2 - Link D Word 2	307	Communication>Datalinks	70
Data Out A1 - Link A Word 1	310	Communication>Datalinks	69
Data Out A2 - Link A Word 2	311	Communication>Datalinks	69
Data Out B1 - Link B Word 1	312	Communication>Datalinks	70
Data Out B2 - Link B Word 2	313	Communication>Datalinks	70
Data Out C1 - Link C Word 1	314	Communication>Datalinks	70
Data Out C2 - Link C Word 2	315	Communication>Datalinks	70
Data Out D1 - Link D Word 1	316	Communication>Datalinks	69
Data Out D2 - Link D Word 2	317	Communication>Datalinks	70
DB Resistor Type	163	Dynamic Control>Stop/Brake Modes	39
DC Brake Level	158	Dynamic Control>Stop/Brake Modes	37
DC Brake Lvl Sel	157	Dynamic Control>Stop/Brake Modes	36
DC Brake Time	159	Dynamic Control>Stop/Brake Modes	37
DC Bus Memory	13	Monitor>Metering	4
DC Bus Voltage	12	Monitor>Metering	4
Decel Time 1	142	Dynamic Control>Ramp Rates	34
Decel Time 2	143	Dynamic Control>Ramp Rates	34
Dig In Status	216	Utility>Diagnostics Inputs & Outputs>Digital Inputs	57
Dig Out Status	217	Utility>Diagnostics	58
Dig Out1 Level	381	Inputs & Outputs>Digital Outputs	86
Dig Out1 OffTime	383	Inputs & Outputs>Digital Outputs	86
Dig Out1 OnTime	382	Inputs & Outputs>Digital Outputs	86
Dig Out2 Level	385	Inputs & Outputs>Digital Outputs	88
Dig Out2 OffTime	387	Inputs & Outputs>Digital Outputs	88
Dig Out2 OnTime	386	Inputs & Outputs>Digital Outputs	88
Digital In1 Sel	361	Inputs & Outputs>Digital Inputs	78
Digital In2 Sel	362	Inputs & Outputs>Digital Inputs	78
Digital In3 Sel	363	Inputs & Outputs>Digital Inputs	78
Digital In4 Sel	364	Inputs & Outputs>Digital Inputs	78
Digital In5 Sel	365	Inputs & Outputs>Digital Inputs	78
Digital In6 Sel	366	Inputs & Outputs>Digital Inputs	78
Digital Out1 Sel	380	Inputs & Outputs>Digital Outputs	85
Digital Out2 Sel	384	Inputs & Outputs>Digital Outputs	87
Direction Mode	190	Utility>Direction Config	48
Drive Alarm 1	211	Utility>Diagnostics Utility>Alarms	55
Drive Alarm 2	212	Utility>Diagnostics Utility>Alarms	55
Drive Checksum	203	Utility>Drive Memory	52

Parameter Name	No.	Path (File>Group)	Page No.
Drive Logic Rslt	271	Communication>Comm Control	65
Drive OL Count	219	Utility>Diagnostics	58
Drive OL Mode	150	Dynamic Control>Load Limits	35
Drive Ramp Rslt	273	Communication>Comm Control	66
Drive Ref Rslt	272	Communication>Comm Control	65
Drive Status 1	209	Utility>Diagnostics	53
Drive Status 2	210	Utility>Diagnostics	54
Drive Temp	218	Utility>Diagnostics	58
Elapsed MWh	9	Monitor>Metering	3
Elapsed Run Time	10	Monitor>Metering	4
Fault Amps	225	Utility>Diagnostics	59
Fault Bus Volts	226	Utility>Diagnostics	59
Fault Clear	240	Utility>Faults	63
Fault Clear Mode	241	Utility>Faults	63
Fault Config 1	238	Utility>Faults	63
Fault Frequency	224	Utility>Diagnostics	59
Flux Current	5	Monitor>Metering	3
Flux Current Ref	63	Motor Control>Torq Attributes	15
Flux Up Mode	57	Motor Control>Torq Attributes	13
Flux Up Time	58	Motor Control>Torq Attributes	13
Flying Start En	169	Dynamic Control>Stop/Restart Modes	41
Flying StartGain	170	Dynamic Control>Stop/Restart Modes	41
IR Voltage Drop	62	Motor Control>Torq Attributes	15
Ixo Volage Drop	64	Motor Control>Torq Attributes	11-12
Language	201	Utility>Drive Memory	51
Last Stop Source	215	Utility>Diagnostics	57
LevelSense Start	168	Dynamic Control>Stop/Restart Modes	40
Load Frm Usr Set	198	Utility>Drive Memory	50
Logic Source Sel	89	Speed Command>Control Src Select	19
Man Ref Preload	193	Utility>OIM Ref Config	49
Manual Mask	286	Communication>Masks & Owners	66
Manual Owner	298	Communication>Masks & Owners	67
Maximum Freq	55	Motor Control>Torq Attributes	11
Maximum Speed	82	Speed Command>Spd Mode & Limits	18
Maximum Voltage	54	Motor Control>Torq Attributes	11
Minimum Speed	81	Speed Command>Spd Mode & Limits	17
MOP Frequency	11	Monitor>Metering	4
MOP Rate	195	Utility>MOP Config	49
Motor NP FLA	42	Motor Control>Motor Data	6
Motor NP Hertz	43	Motor Control>Motor Data	7
Motor NP Power	45	Motor Control>Motor Data	8
Motor NP RPM	44	Motor Control>Motor Data	7
Motor NP Volts	41	Motor Control>Motor Data	6
Motor OL Count	220	Utility>Diagnostics	59
Motor OL Factor	48	Motor Control>Motor Data	9

Parameter Name	No.	Path (File>Group)	Page No.
Motor OL Hertz	47	Motor Control>Motor Data	8
Motor Type	40	Motor Control>Motor Data	6
Mtr NP Pwr Units	46	Motor Control>Motor Data	8
Output Current	3	Monitor>Metering	2
Output Freq	1	Monitor>Metering	2
Output Power	7	Monitor>Metering	3
Output Powr Fctr	8	Monitor>Metering	3
Output Voltage	6	Monitor>Metering	3
Overspeed Limit	83	Speed Command>Spd Mode & Limits	18
PI Configuration	124	Speed Command>Process PI	26
PI Control	125	Speed Command>Process PI	27
PI Error Meter	137	Speed Command>Process PI	33
PI Fdback Meter	136	Speed Command>Process PI	33
PI Feedback Sel	128	Speed Command>Process PI	30
PI Integral Time	129	Speed Command>Process PI	30
PI Lower Limit	131	Speed Command>Process PI	31
PI Output Meter	138	Speed Command>Process PI	33
PI Preload	133	Speed Command>Process PI	31
PI Prop Gain	130	Speed Command>Process PI	30
PI Ref Meter	135	Speed Command>Process PI	32
PI Reference Sel	126	Speed Command>Process PI	29
PI Setpoint	127	Speed Command>Process PI	29
PI Status	134	Speed Command>Process PI	32
PI Upper Limit	132	Speed Command>Process PI	31
Power Loss Level	186	Dynamic Control>Power Loss	11-40
Power Loss Mode	184	Dynamic Control>Stop/Power Loss	47
Power Loss Time	185	Dynamic Control>Stop/Power Loss	47
Power Up Marker	242	Utility>Faults	64
Preset Speed 1	101	Speed Command>Discrete Speeds	22
Preset Speed 2	102	Speed Command>Discrete Speeds	22
Preset Speed 3	103	Speed Command>Discrete Speeds	22
Preset Speed 4	104	Speed Command>Discrete Speeds	22
Preset Speed 5	105	Speed Command>Discrete Speeds	22
Preset Speed 6	106	Speed Command>Discrete Speeds	22
Purge Speed	107	Speed Command>Discrete Speeds	23
Rated Amps	28	Monitor>Drive Data	5
Rated kW	26	Monitor>Drive Data	5
Rated Volts	27	Monitor>Drive Data	5
Reset Meters	200	Utility>Drive Memory	51
Reset To Defalts	197	Utility>Drive Memory	50
Run Boost	70	Motor Control>Volts per Hertz	16
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43	Motor NP Hertz	Motor Control>Motor Data	
44	Motor NP RPM	Motor Control>Motor Data	
45	Motor NP Power	Motor Control>Motor Data	
46	Mtr NP Pwr Units	Motor Control>Motor Data	
54	Maximum Voltage	Motor Control>Torq Attributes	
55	Maximum Freq	Motor Control>Torq Attributes	
70	Run Boost	Motor Control>Volts per Hertz	
80	Speed Mode	Speed Command>Spd Mode & Limits	
81	Minimum Speed	Speed Command>Spd Mode & Limits	
82	Maximum Speed	Speed Command>Spd Mode & Limits	
84	Skip Frequency 1	Speed Command>Spd Mode & Limits	
89	Logic Source Select	Speed Command>Control Src Select	
90	Speed Ref A Sel	Speed Command>Control Src Select Speed Command>Speed References	
91	Speed Ref A Hi	Speed Command>Speed References	
92	Speed Ref A Lo	Speed Command>Speed References	
107	Purge Speed	Speed Command>Discrete Speeds	
140	Accel Time 1	Dynamic Control>Ramp Rates	
142	Decel Time 1	Dynamic Control>Ramp Rates	
146	S Curve %	Dynamic Control>Ramp Rates	
148	Current Lmt Val	Dynamic Control>Load Limits	
150	Drive OL Mode	Dynamic Control>Load Limits	
151	CarrierFrequency	Dynamic Control>Load Limits	
155	Stop Mode A	Dynamic Control>Stop/Brake Modes	
168	LevelSense Start	Dynamic Control>Stop/Restart Modes	
174	Auto Rstrt Tries	Dynamic Control>Stop/Restart Modes	
175	Auto Rstrt Delay	Dynamic Control>Stop/Restart Modes	
197	Reset To Defalts	Utility>Drive Memory	
200	Reset Meters	Utility>Drive Memory	
320	Anlg In Config	Inputs & Outputs>Analog Inputs	
321	Anlg In Sqr Root	Inputs & Outputs>Analog Inputs	
322	Analog In 1 Hi	Inputs & Outputs>Analog Inputs	
323	Analog In 1 Lo	Inputs & Outputs>Analog Inputs	
324	Analog In 1 Loss	Inputs & Outputs>Analog Inputs	
340	Anlg Out Config	Inputs & Outputs>Analog Outputs	
342	Analog Out1 Sel	Inputs & Outputs>Analog Outputs	
343	Analog Out1 Hi	Inputs & Outputs>Analog Outputs	
344	Analog Out1 Lo	Inputs & Outputs>Analog Outputs	

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380	Digital Out1 Sel	Inputs & Outputs>Digital Outputs	
381	Dig Out1 Level	Inputs & Outputs>Digital Outputs	
384	Digital Out2 Sel	Inputs & Outputs>Digital Outputs	
385	Dig Out2 Level	Inputs & Outputs>Digital Outputs	

Record of User Settings: Advanced Access Level

No.	Parameter Name	Path (File>Group)	Setting
40	Motor Type	Motor Control>Motor Data	
41	Motor NP Volts	Motor Control>Motor Data	
42	Motor NP FLA	Motor Control>Motor Data	
43	Motor NP Hertz	Motor Control>Motor Data	
44	Motor NP RPM	Motor Control>Motor Data	
45	Motor NP Power	Motor Control>Motor Data	
46	Mtr NP Pwr Units	Motor Control>Motor Data	
47	Motor OL Hertz	Motor Control>Motor Data	
48	Motor OL Factor	Motor Control>Motor Data	
53	Torque Perf Mode	Motor Control>Torq Attributes	
54	Maximum Voltage	Motor Control>Torq Attributes	
55	Maximum Freq	Motor Control>Torq Attributes	
56	Compensation	Motor Control>Torq Attributes	
57	Flux Up Mode	Motor Control>Torq Attributes	
58	Flux Up Time	Motor Control>Torq Attributes	
59	SV Boost Filter	Motor Controls>Torq Attributes	
61	Autotune	Motor Control>Torq Attributes	
62	IR Voltage Drop	Motor Control>Torq Attributes	
63	Flux Current Ref	Motor Control>Torq Attributes	
64	Ixo Voltage Drop	Motor Control>Torq Attributes	
69	Start/Acc Boost	Motor Control>Volts per Hertz	
70	Run Boost	Motor Control>Volts per Hertz	
71	Break Voltage	Motor Control>Volts per Hertz	
72	Break Frequency	Motor Control>Volts per Hertz	
80	Speed Mode	Speed Command>Spd Mode & Limits	
81	Minimum Speed	Speed Command>Spd Mode & Limits	
82	Maximum Speed	Speed Command>Spd Mode & Limits	
83	Overspeed Limit	Speed Command>Spd Mode & Limits	
84	Skip Frequency 1	Speed Command>Spd Mode & Limits	
85	Skip Frequency 2	Speed Command>Spd Mode & Limits	
86	Skip Frequency 3	Speed Command>Spd Mode & Limits	
87	Skip Freq Band	Speed Command>Spd Mode & Limits	
89	Logic Source Select	Speed Command>Control Src Select	
90	Speed Ref A Sel	Speed Command>Control Src Select Speed Command>Speed References	
91	Speed Ref A Hi	Speed Command>Speed References	
92	Speed Ref A Lo	Speed Command>Speed References	
101	Preset Speed 1	Speed Command>Discrete Speeds	
102	Preset Speed 2	Speed Command>Discrete Speeds	
103	Preset Speed 3	Speed Command>Discrete Speeds	

No.	Parameter Name	Path (File>Group)	Setting
104	Preset Speed 4	Speed Command>Discrete Speeds	
105	Preset Speed 5	Speed Command>Discrete Speeds	
106	Preset Speed 6	Speed Command>Discrete Speeds	
107	Purge Speed	Speed Command>Discrete Speeds	
117	Trim In Select	Speed Commands>Speed Trim	
118	Trim Out Select	Speed Command>Speed Trim	
119	Trim Hi	Speed Command>Speed Trim	
120	Trim Lo	Speed Command>Speed Trim	
121	Slip RPM @ FLA	Speed Command>Slip Comp	
122	Slip Comp Gain	Speed Command>Slip Comp	
124	PI Configuration	Speed Command>Process PI	
125	PI Control	Speed Command>Process PI	
126	PI Reference Sel	Speed Command>Process PI	
127	PI Setpoint	Speed Command>Process PI	
128	PI Feedback Sel	Speed Command>Process PI	
129	PI Integral Time	Speed Command>Process PI	
130	PI Prop Gain	Speed Command>Process PI	
131	PI Lower Limit	Speed Command>Process PI	
132	PI Upper Limit	Speed Command>Process PI	
133	PI Preload	Speed Command>Process PI	
140	Accel Time 1	Dynamic Control>Ramp Rates	
141	Accel Time 2	Dynamic Control>Ramp Rates	
142	Decel Time 1	Dynamic Control>Ramp Rates	
143	Decel Time 2	Dynamic Control>Ramp Rates	
146	S Curve %	Dynamic Control>Ramp Rates	
147	Current Lmt Sel	Dynamic Control>Ramp Rates	
148	Current Lmt Val	Dynamic Control>Load Limits	
149	Current Lmt Gain	Dynamic Control>Load Limits	
150	Drive OL Mode	Dynamic Control>Load Limits	
151	CarrierFrequency	Dynamic Control>Load Limits	
155	Stop Mode A	Dynamic Control>Stop/Brake Modes	
156	Stop Mode B	Dynamic Control>Stop/Brake Modes	
157	DC Brake Lvl Sel	Dynamic Control>Stop/Brake Modes	
158	DC Brake Level	Dynamic Control>Stop/Brake Modes	
159	DC Brake Time	Dynamic Control>Stop/Brake Modes	
160	Bus Reg Ki	Dynamic Control>Stop/Brake Modes	
161	Bus Reg Mode A	Dynamic Control>Stop/Brake Modes	
162	Bus Reg Mode B	Dynamic Control>Stop/Brake Modes	
163	DB Resistor Type	Dynamic Control>Stop/Brake Modes	
164	Bus Reg Kp	Dynamic Control>Stop/Brake Modes	
165	Bus Reg Kd	Dynamic Control>Stop/Brake Modes	
168	LevelSense Start	Dynamic Control>Stop/Restart Modes	
169	Flying Start En	Dynamic Control>Stop/Restart Modes	
170	Flying StartGain	Dynamic Control>Stop/Restart Modes	
174	Auto Rstrt Tries	Dynamic Control>Stop/Restart Modes	
175	Auto Rstrt Delay	Dynamic Control>Stop/Restart Modes	

No.	Parameter Name	Path (File>Group)	Setting
178	Sleep-Wake Mode	Dynamic Control>Restart Modes	
179	Sleep-Wake Ref	Dynamic Control>Restart Modes	
180	Wake Level	Dynamic Control>Restart Modes	
181	Wake Time	Dynamic Control>Restart Modes	
182	Sleep Level	Dynamic Control>Restart Modes	
183	Sleep Time	Dynamic Control>Restart Modes	
184	Power Loss Mode	Dynamic Control>Stop/Power Loss	
185	Power Loss Time	Dynamic Control>Stop/Power Loss	
186	Power Loss Level	Dynamic Control>Power Loss	
190	Direction Mode	Utility>Direction Config	
192	Save OIM Ref	Utility>OIM Ref Config	
193	Man Ref Preload	Utility>OIM Ref Config	
194	Save MOP Ref	Utility>MOP Config	
195	MOP Rate	Utility>MOP Config	
197	Reset To Defaults	Utility>Drive Memory	
198	Load Frm Usr Set	Utility>Drive Memory	
199	Save To User Set	Utility>Drive Memory	
200	Reset Meters	Utility>Drive Memory	
201	Language	Utility>Drive Memory	
202	Voltage Class	Utility>Drive Memory	
234	Testpoint 1 Sel	Utility>Diagnostics	
235	Testpoint 1 Data	Utility>Diagnostics	
236	Testpoint 2 Sel	Utility>Diagnostics	
237	Testpoint 2 Data	Utility>Diagnostics	
238	Fault Config 1	Utility>Faults	
240	Fault Clear	Utility>Faults	
241	Fault Clear Mode	Utility>Faults	
259	Alarm Config 1	Utility>Alarms	
286	Manual Mask	Communication>Masks & Owners	
298	Manual Owner	Communication>Masks & Owners	
300	Data In A1 - Link A Word 1	Communication>Datalinks	
301	Data In A2 - Link A Word 2	Communication>Datalinks	
302	Data In B1 - Link B Word 1	Communication>Datalinks	
303	Data In B2 - Link B Word 2	Communication>Datalinks	
304	Data In C1 - Link C Word 1	Communication>Datalinks	
305	Data In C2 - Link C Word 2	Communication>Datalinks	
306	Data In D1 - Link D Word 1	Communication>Datalinks	
307	Data In D2 - Link D Word 2	Communication>Datalinks	
310	Data Out A1 - Link A Word 1	Communication>Datalinks	
311	Data Out A2 - Link A Word 2	Communication>Datalinks	
312	Data Out B1 - Link B Word 1	Communication>Datalinks	
313	Data Out B2 - Link B Word 2	Communication>Datalinks	
314	Data Out C1 - Link C Word 1	Communication>Datalinks	
315	Data Out C2 - Link C Word 2	Communication>Datalinks	
316	Data Out D1 - Link D Word 1	Communication>Datalinks	
317	Data Out D2 - Link D Word 2	Communication>Datalinks	

No.	Parameter Name	Path (File>Group)	Setting
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321	Anlg In Sqr Root	Inputs & Outputs>Analog Inputs	
322	Analog In 1 Hi	Inputs & Outputs>Analog Inputs	
323	Analog In 1 Lo	Inputs & Outputs>Analog Inputs	
324	Analog In 1 Loss	Inputs & Outputs>Analog Inputs	
325	Analog In 2 Hi	Inputs & Outputs>Analog Inputs	
326	Analog In 2 Lo	Inputs & Outputs>Analog Inputs	
327	Analog In 2 Loss	Inputs & Outputs>Analog Inputs	
341	Anlg Out Absolut	Inputs & Outputs>Analog Outputs	
342	Analog Out1 Sel	Inputs & Outputs>Analog Outputs	
343	Analog Out1 Hi	Inputs & Outputs>Analog Outputs	
344	Analog Out1 Lo	Inputs & Outputs>Analog Outputs	
361	Digital In1 Sel	Inputs & Outputs>Digital Inputs	
362	Digital In2 Sel	Inputs & Outputs>Digital Inputs	
363	Digital In3 Sel	Inputs & Outputs>Digital Inputs	
364	Digital In4 Sel	Inputs & Outputs>Digital Inputs	
365	Digital In5 Sel	Inputs & Outputs>Digital Inputs	
366	Digital In6 Sel	Inputs & Outputs>Digital Inputs	
380	Digital Out1 Sel	Inputs & Outputs>Digital Outputs	
381	Dig Out1 Level	Inputs & Outputs>Digital Outputs	
382	Dig Out1 OnTime	Inputs & Outputs>Digital Outputs	
383	Dig Out1 OffTime	Inputs & Outputs>Digital Outputs	
384	Digital Out2 Sel	Inputs & Outputs>Digital Outputs	
385	Dig Out2 Level	Inputs & Outputs>Digital Outputs	
386	Dig Out2 OnTime	Inputs & Outputs>Digital Outputs	
387	Dig Out2 OffTime	Inputs & Outputs>Digital Outputs	

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